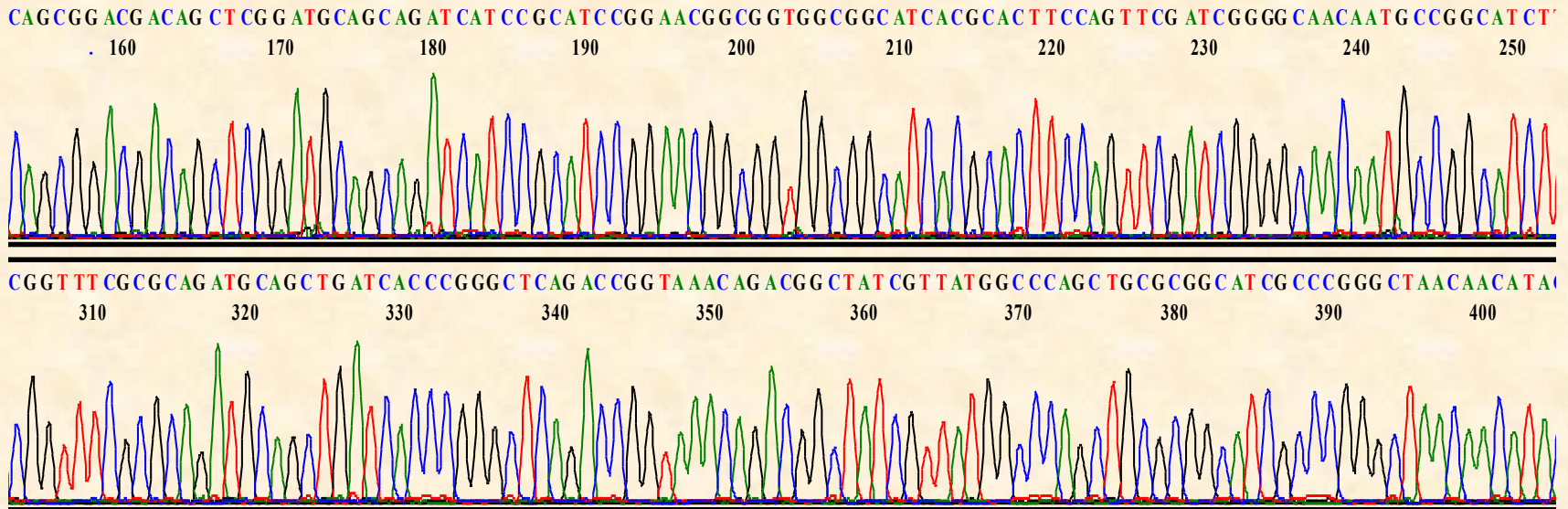


Molekulárně biologické databáze

Pro zajímavost...

Důležité...

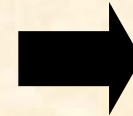
Molekulárně biologická data



GATAGCGTAATGATCGGCTGGCTGCCGATTTTCATGCTGGTTTCCCAACGAAAAA TAACCGCTCACGGTGCCATCACGATCGCACACCGCAAATCGGCGG
TACAGGTGGTCGCGCCCGCCGACACATCGCTGCGCCAATAATGATCTTTCAGCGGACGACAGCTCGGATGCAGCAGATCATCCGCATCCGGAACGGC
GGTGGCGGCATCACGCACCTTCCAGTTCGATCGGGGCAACAATGCCGGCATCTTTCAGGGCAAAGCGAATAAACAGCACGCTCACCTTCCGCGGCAGCGCC
AGCGCGGTTTCGCGCAGATGCAGCTGATCACCCGGGCTCAGACCGGTAAACAGACGGCTATCGTTATGGCCAGCTGCGCGGCATCGCCCGGGCTAAACA
CATACAGGTGGCGACCATCAATCACGGTCGGGGCGCCGGATCACGGCTGGCTTCCGGATAGGCGCTCAGCAGGGTAACGGCATCCACAATCACCAGCAT

Molekulárně biologická data

MALDI-TOF



Identifikace proteinů



Sekvence proteinů

MDRNGNFSLPPNTAFKAIIFYANAADRQDLK

LFIDDAPEPAATFVGNSEEDGVRLFTLNSKG

GKIRIEASANGRQSATDARLAPLSAGDTVW

LGWLGAEDGADADYNDGIVILQWPIT

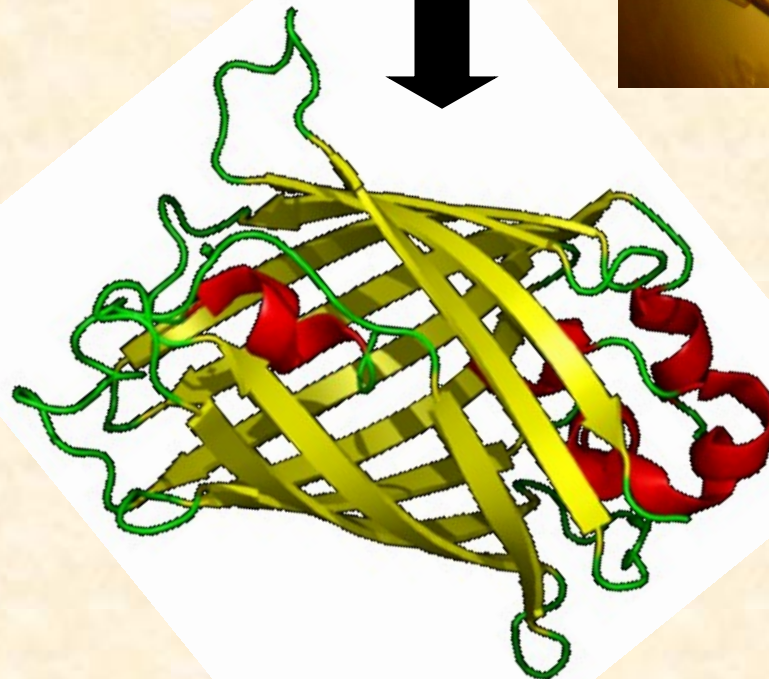
Molekulárně biologická data



NMR spektroskopie



Proteinová
krystalografie



Molekulárně biologická data

- **Výkonné technologie:**

Automatické sekvencování

MALDI-TOF

NMR spektroskopie

Proteinová krystalografie

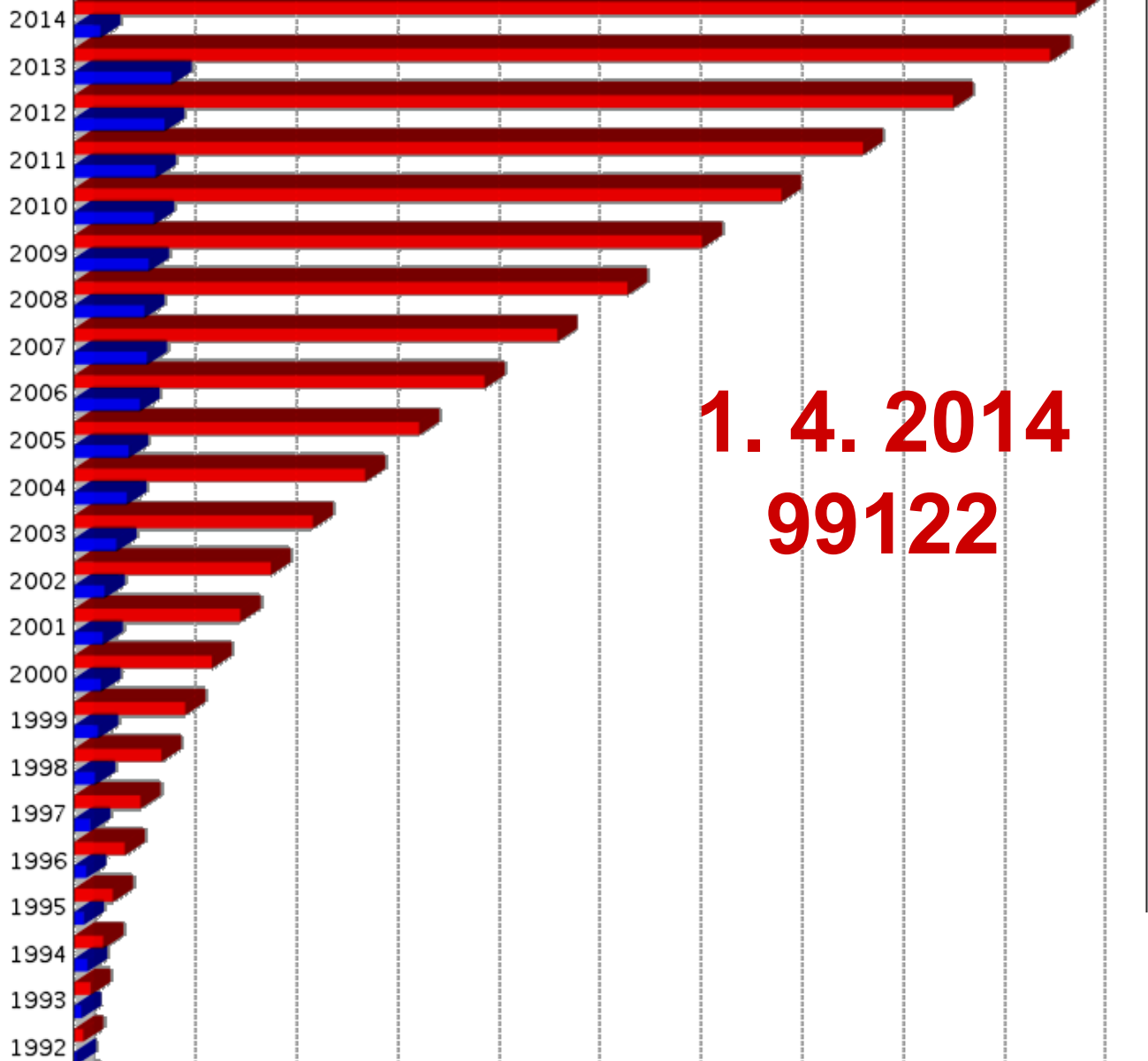
Výrazný nárůst množství biologických dat.

Yearly Growth of Total Structures

number of structures can be viewed by hovering mouse over the bar

Number

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000 90,000 100,000

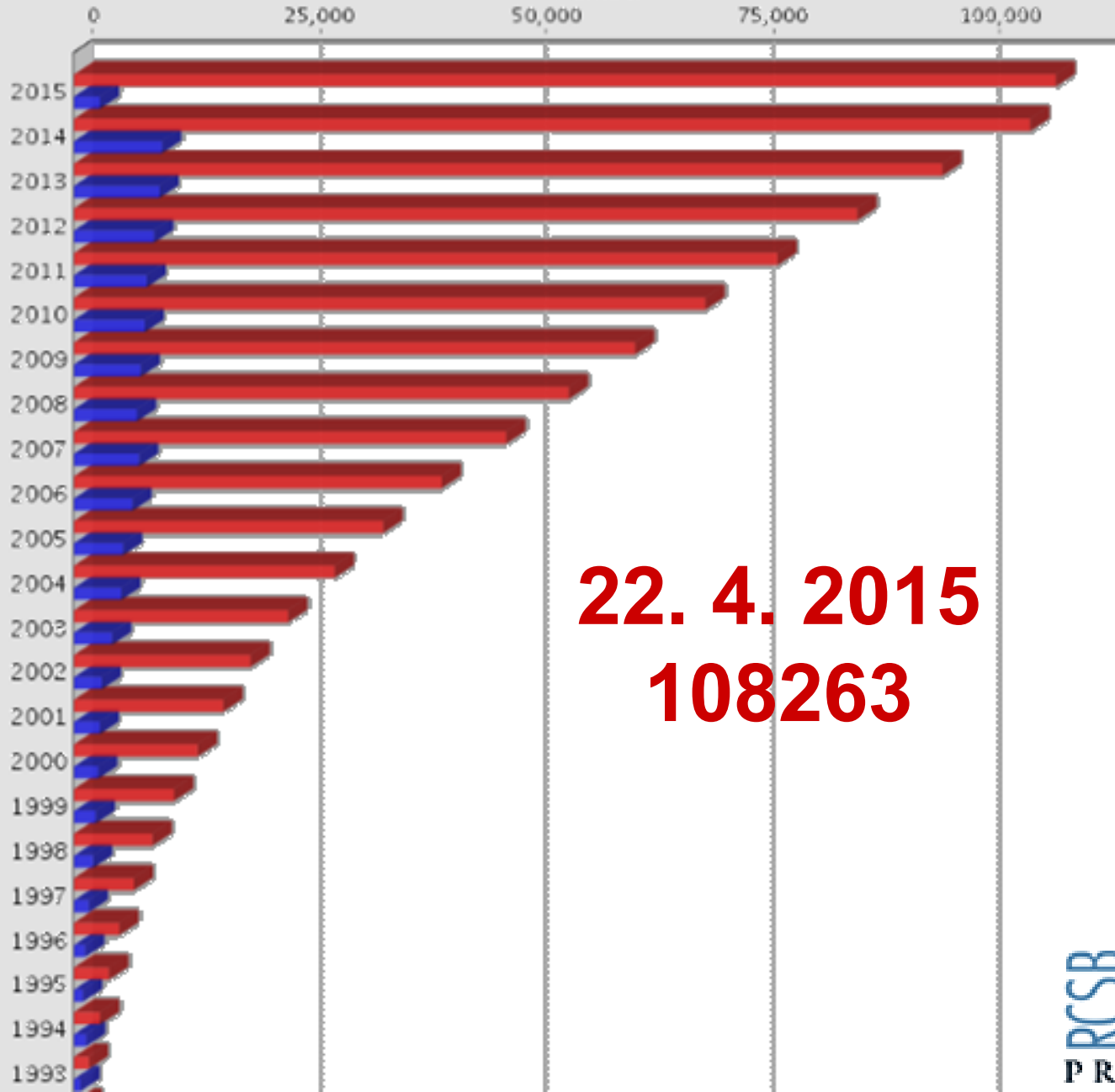


1. 4. 2014
99122

Yearly Growth of Total Structures

number of structures can be viewed by hovering mouse over the bar

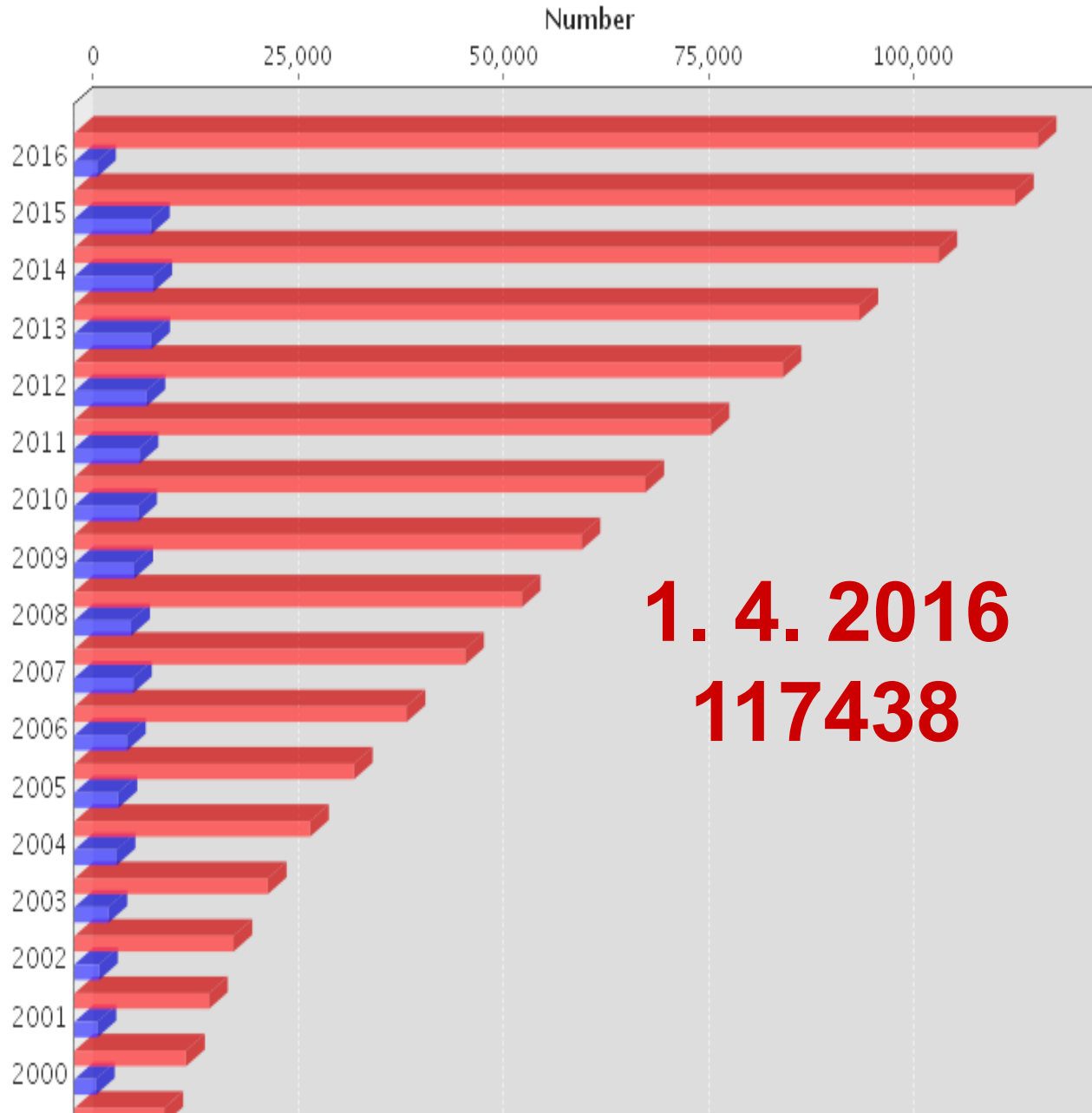
Number



22. 4. 2015
108263

Yearly Growth of Total Structures

number of structures can be viewed by hovering mouse over the bar

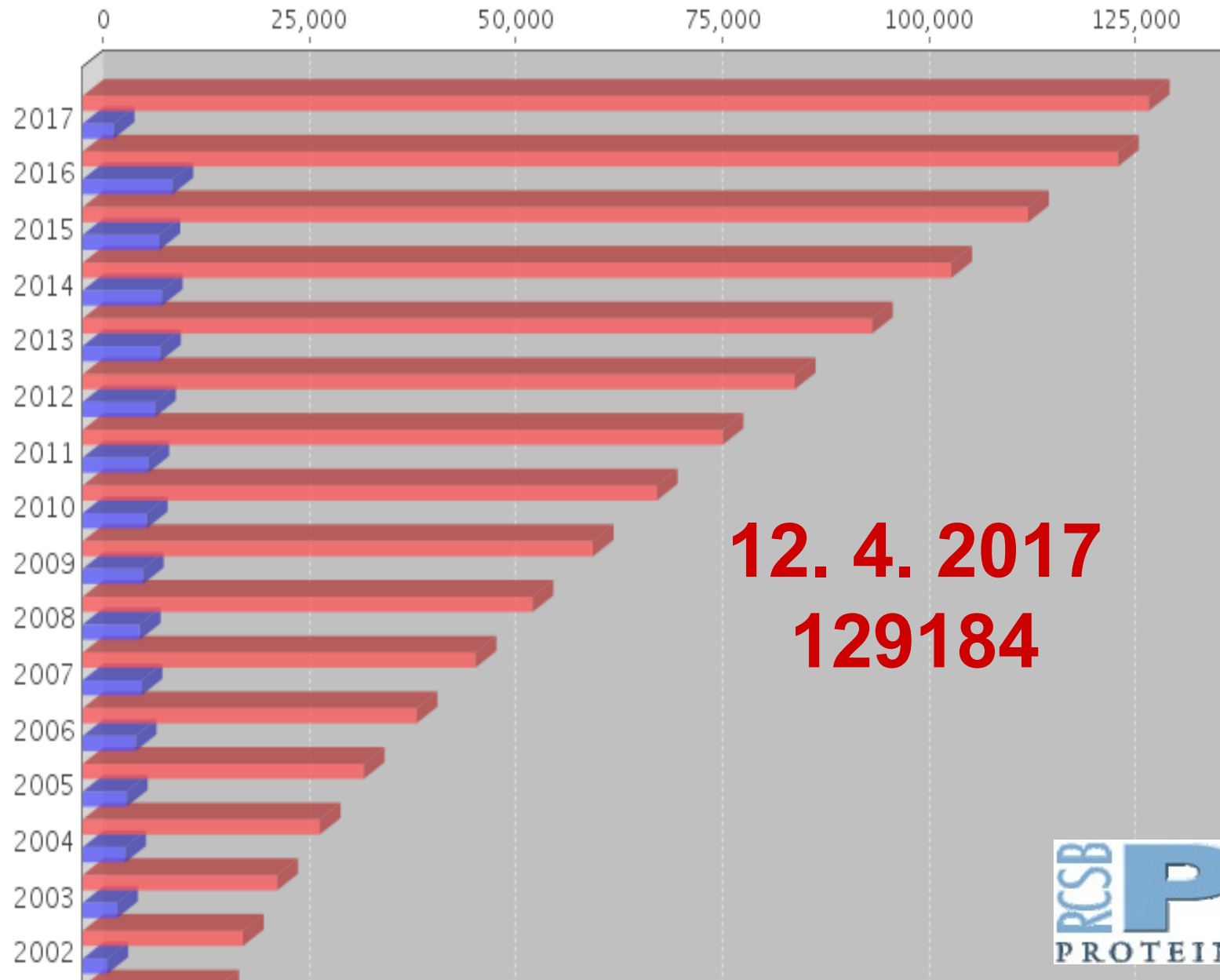


1. 4. 2016
117438

Yearly Growth of Total Structures

number of structures can be viewed by hovering mouse over the bar

Number



12. 4. 2017
129184

Éra reverzní genetiky

Klasická genetiká



GATAGCGTAATGATCGGCTGGCTGCCGATTTTC
TACAGGTGGTCGCGCCCGCCGCCAGCACATCGC
GGTGGCGGCATCACGCACTTCCAGTTCGATCGC
AGCGCGGTTTCGCGCAGATGCAGCTGATCACCC

Fenotyp



Genotyp

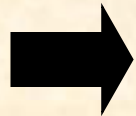
Éra reverzní genetiky

Klasická genetik



```
GATAGCGTAATGATCGGCTGGCTGCCGCATTTTC  
TACAGGTGGTCGCGCCCGCCGCCAGCACATCGC  
GGTGGCGGCATCACGCACTTCCAGTTCGATCGC  
AGCGCGGTTTCGCGCAGATGCAGCTGATCACCC
```

Fenotyp



Genotyp

Reverzní genetik

Automatické DNA
sekvencování



Produkce velkého
množství dat

```
GATAGCGTAATGATCGGCTGGCTGCCGCAT  
TACAGGTGGTCGCGCCCGCCGCCAGCACAT
```



Genotyp



Fenotyp

Molekulárně biologická data

- **Nutnost organizovaného ukládání a skladování dat.**



Databáze je určitá uspořádaná množina informací (dat) uložená na paměťovém médiu.

Molekulárně biologická data

- **Nutnost organizovaného ukládání a skladování dat.**
- **Nutnost prohlížení a analyzování uložených dat.**



Databáze je určitá uspořádaná množina informací (dat) uložená na paměťovém médiu.

V širším smyslu jsou součástí databáze i softwarové prostředky, které umožňují manipulaci s uloženými daty a přístup k nim.

Analytické nástroje

- **Vyhledávací software**

Nutnost snadného, rychlého a specifického vyhledání informací.

- **Srovnávání dat (sekvencí)**

Sequence alignment – „seřazení“ sekvencí.

```
LPPNTAFKAI FYANAADRQDLKLFIDDAPEPAATFVGNSEDGVRL--FTLNSKGGKIRIE
IPPNTDFRAIFFANAAEQQHIKLFIGDSQEPAA YHKL TTRDGP RE--ATLNSGNGKIRFE
LPPHIKFGVTALTHAANDQTIDIYIDDDPKPAATFKGAGA QDQNLG TKVLD SGN GRV RVI
LPPNIAFGVTALVNSSAPQTIEVFVDDNPKPAATFQGAGTQDANLNTQIVNSGKGKVRVV
lPPn-aFg---lanaad-QtiklfidD-p-PAAtfkgag-----l-t-tlnSgnGkiRve
```

```
ASANGRQSATDARLAPLSAGD-----TVWLGWLGAEEDGADADYNDGIVILQWPIT
VSVNGKPSATDARLAPINGKKS DGSPFTVNF GIVVSE DGHDSDYNDGIVVLQWPIG
VMANGRPSRLGSRQVDIFKKS-----YFGIIGSE DGADDDYNDGIVFLNWPLG
VTANGKPSKIGSRQVDIFKKT-----YFGLVGS EDGGDGDYNDGIAILNWPLG
vsanGrpSat--R---ifkks-----tvyfGivgsEDGaDaDYNDGiviLqWPig
```


Rozdělení molekulárně biologických databází

- **Databáze:**

Primární

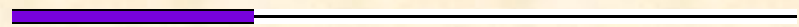
Sekundární

Strukturní

```
EDRPIKFSTEGATSQSYKQFIEALRERLRGGLIHDIPVLPDPTTLQERNRYIT
VELSNSDTESEIEVGIDVTNAYVVAYRAGTQSYFLRDAPSSASDYLFRTGTDQHS
LPFYGTYGDLERWAHQSRQQIPLGLQALTHGISFFRSGGNDNEEKARTLIVII
QMVAEAAARFRYISNRVRVSIQTGTAFQPDAAAMISLENNWDNLSRGVQESVQDT
FPNQVTLTNIRNEPVIIVDSLSSHPTVAVLALMLFVCNPPNIVEKSKICSSRYEP
TVRIGGRDGMCDVVDNGYHNGNRIIMWKCKDRLEENQLWTLKSDKTIRSNGK
```



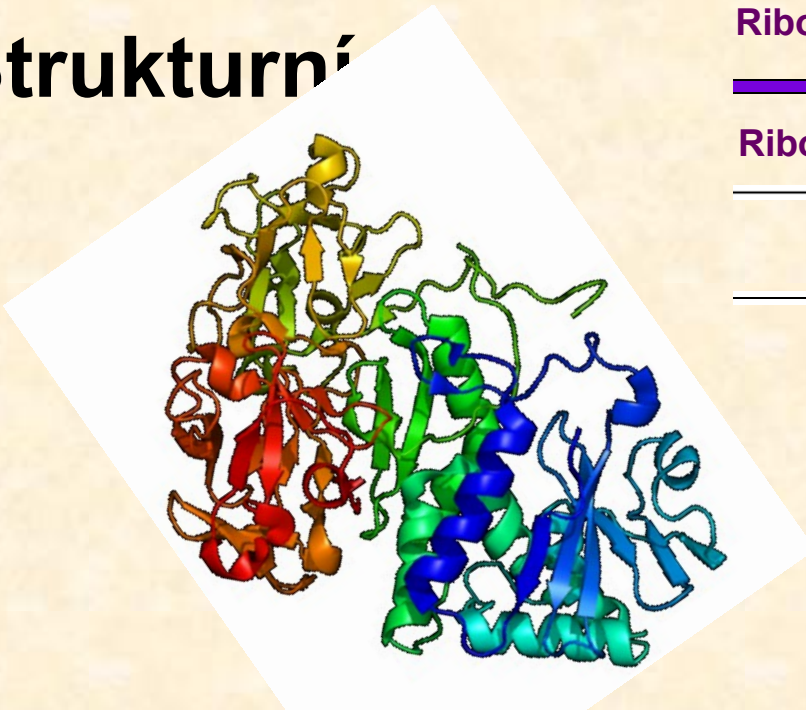
Ribosome-inactivating protein, subdomain 1



Ribosome-inactivating protein, subdomain 2



Ricin B-like lectins



Rozdělení molekulárně biologických databází

- **Databáze:**

Primární

Sekundární

Strukturní

```
EDRPIKFSTEGATSQSYKQFIEALRERLRGGLIHDIPVLPDPTTLQERNRYIT  
VELSNSDTESEIEVGIDVTNAYVVAYRAGTQSYFLRDAPSSASDYLF TGTDQHS  
LPFYGTYGDLERWAHQSRQQIPLGLQALTHGISFFRSGGNDNEEKARTLIVII  
QMVAEAARFRYISNRVRSIQGTAFQPDAAAMISLENNWDNLSRGVQESVQDT  
FPNQVTLTNIRNEPVIIVDSLHPTVAVLALMLFVCNPPNIVEKSKICSSRYEP  
TVRIGGRDGMCDVDVYDNGYHNGNRIIMWKCKDRLEENQLWTLKSDKTIRSNGK
```

**Primární databáze obsahují anotované sekvence
NA nebo proteinů.**

Rozdělení molekulárně biologických databází

- **Databáze:**
 - Primární**
 - Sekundární**
 - Strukturní**

```
EDRPIKFSTEGATSQSYKQFIEALRERLRGGLIHDIPVLPDPTTLQERNRYIT  
VELSNSDTESEIEVGIDVTNAYVVAYRAGTQSYFLRDAPSSASDYLFTGTDQHS  
LPFYGTYGDLERWAHQSRQQIPLGLQALTHGISFFRSGGNDNEEKARTLIVII  
QMVAEAARFRYISNRVRVSIQTGTAFQPDAAAMISLENNWDNLSRGVQESVQDT  
FPNQVTLTNIRNEPVIIVDSLSSHPTVAVLALMLFVCNPPNIVEKSKICSSRYEP  
TVRIGGRDGMCVDVYDNGYHNGNRIIMWKCKDRLEENQLWTLKSDKTIRSNGK
```



Ribosome-inactivating protein, subdomain 1



Ribosome-inactivating protein, subdomain 2



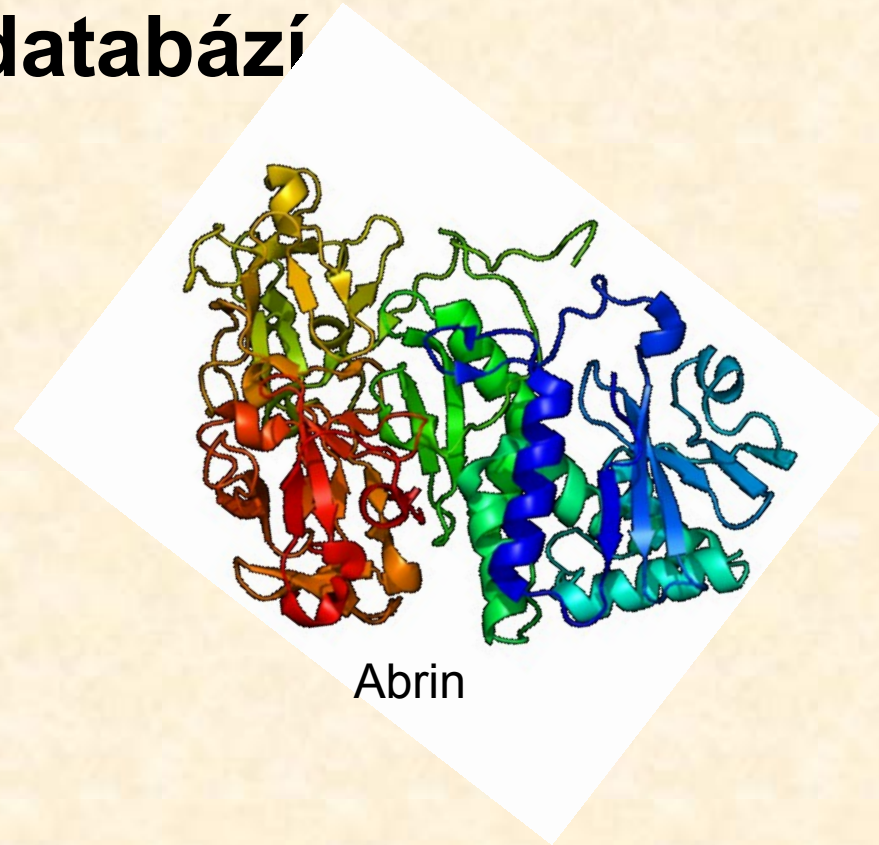
Ricin B-like lectins



Sekundární databáze obsahují informace odvozené z primárních databází ve formě charakteristických vzorů sekvencí, tj. funkčních nebo strukturních motivů získaných srovnáním primárních dat (sekvencí).

Rozdělení molekulárně biologických databází

- **Databáze:**
 - Primární**
 - Sekundární**
 - Strukturní**

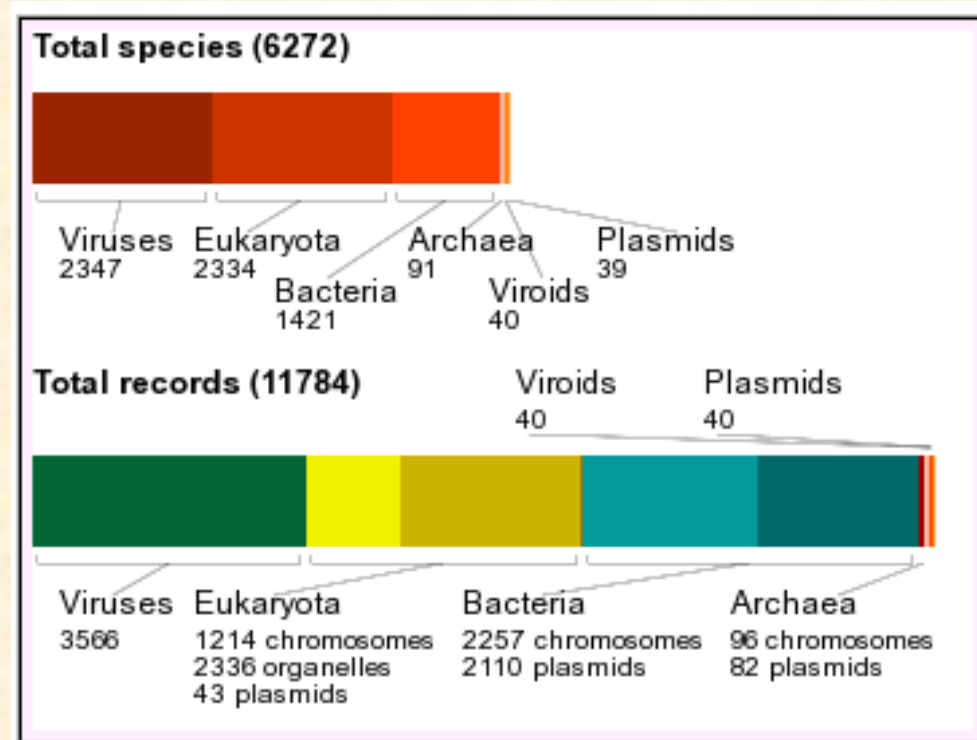


Obsahují struktury proteinů (nukleových kyselin) a jejich anotace.

Rozdělení molekulárně biologických databází

- **Databáze:**
 - Primární
 - Sekundární
 - Strukturní

Genomové zdroje



Rozdělení molekulárně biologických databází

- **Databáze:**
Specializované
Univerzální

Rozdělení molekulárně biologických databází

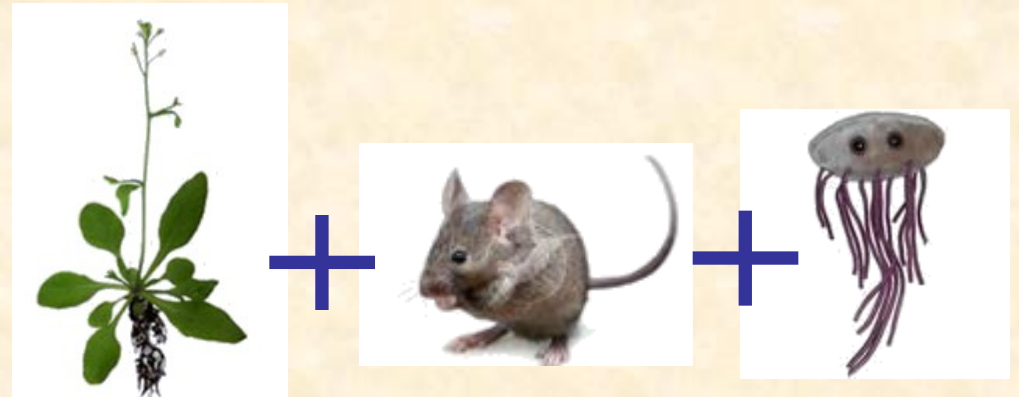
- **Databáze:**
Specializované
Univerzální



Specializované databáze obsahují informace o určité proteinové rodině nebo skupině proteinů, případně o určitém organismu.

Rozdělení molekulárně biologických databází

- **Databáze:**
Specializované
Univerzální



Univerzální databáze obsahují informace o proteinech (NA) ze všech organismů.

Rozdělení univerzálních proteinových databází

- **Univerzální databáze:**

„Skladiště“ sekvencí – sequence repository

„Manuálně“ spravovaná – curated database

Rozdělení univerzálních proteinových databází

- **„Skladiště“ sekvencí – sequence repository**

Kromě sekvencí obsahují málo nebo žádné dodatečné informace.

Záznamy generovány automaticky.

Proteiny mohou být zastoupeny několika různými záznamy (sekvencemi) = „nadbytečnost“ (redundance) sekvencí.

Rozdělení univerzálních proteinových databází

- **Manuálně spravované – curated databases**

Záznamy obsahují dodatečné informace.

Informace jsou před vložením do databáze validovány experty.

Všechny záznamy o stejné proteinové sekvenci jsou sdružovány do jediného = non-redundant dataset.

Rozdělení molekulárně biologických databází

- **Databáze:**

Primární

Sekundární

Strukturní

Genomové zdroje

Složené databáze

Složené databáze

- **Složené (composite) databáze:**

Slučují data z několika primárních databází.

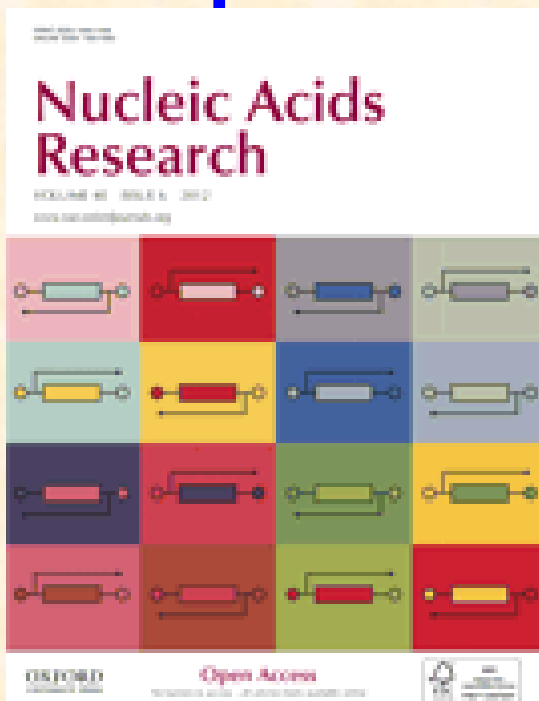
Eliminace redundantních dat.

Různá priorita zdrojových databází podle kvality validace a anotace (eliminace redundantních dat z databáze s nižší prioritou).

Molekulárně biologické databáze

Nucleic Acids Research

<http://www3.oup.co.uk/nar/database/a/>



[Nucleotide Sequence Databases](#)
[International Nucleotide Sequence Database Collaboration](#)
[Coding and non-coding DNA](#)
[Gene structure, introns and exons, splice sites](#)
[Transcriptional regulator sites and transcription factors](#)
[RNA sequence databases](#)
[Protein sequence databases](#)
[Structure Databases](#)

[Genomics Databases \(non-vertebrate\)](#)
[Metabolic and Signaling Pathways](#)
[Human and other Vertebrate Genomes](#)
[Human Genes and Diseases](#)
[Microarray Data and other Gene Expression Databases](#)
[Proteomics Resources](#)
[Other Molecular Biology Databases](#)
[Organelle databases](#)
[Plant databases](#)
[Immunological databases](#)

2012: 1380 databází

Molekulárně biologické databáze

Nucleic Acids Research

<http://www3.oup.co.uk/nar/database/a/>



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2013: 1512 databází

Molekulárně biologické databáze

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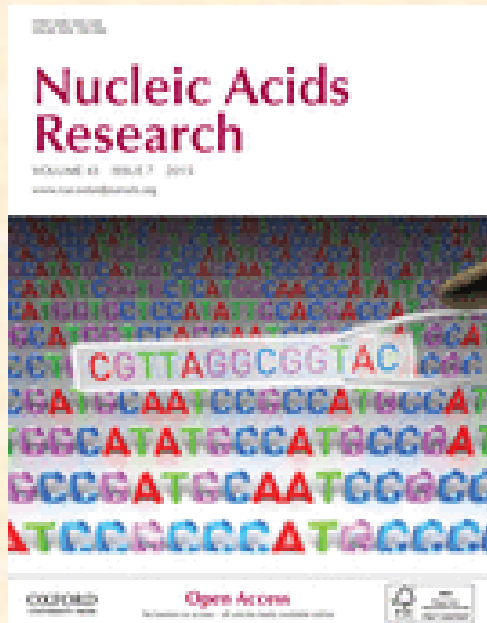
[Genomics Databases \(non-vertebrate\)](#)
[Metabolic and Signaling Pathways](#)
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[Immunological databases](#)

2014: 1552 databází

Molekulárně biologické databáze

Nucleic Acids Research

http://www.oxfordjournals.org/our_journals/nar/database/a/



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[Gene structure, introns and exons, splice sites](#)
[Transcriptional regulator sites and transcription factors](#)
[RNA sequence databases](#)
[Protein sequence databases](#)
[Structure Databases](#)

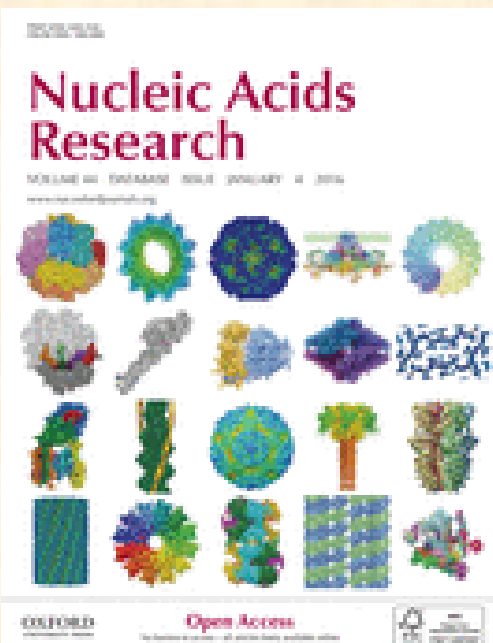
[Genomics Databases \(non-vertebrate\)](#)
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[Human Genes and Diseases](#)
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2015: 1549 databází

Molekulárně biologické databáze

Nucleic Acids Research

http://www.oxfordjournals.org/our_journals/nar/database/a/



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[RNA sequence databases](#)
[Protein sequence databases](#)
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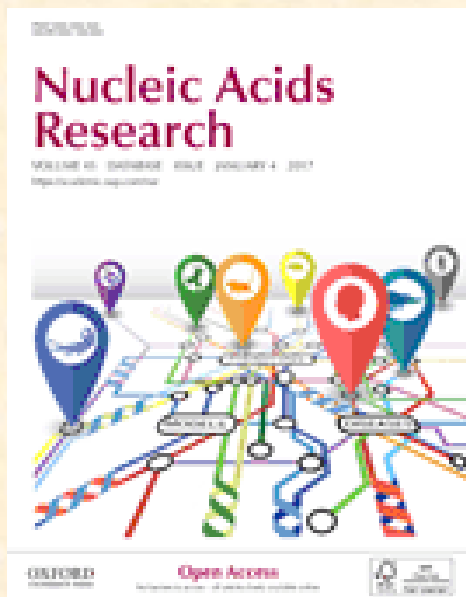
[Genomics Databases \(non-vertebrate\)](#)
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[Immunological databases](#)

2016: 1685 databází

Molekulárně biologické databáze

Nucleic Acids Research

http://www.oxfordjournals.org/our_journals/nar/database/a/



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2017: 1712 databází

<https://academic.oup.com/nar/issue/45/D1>

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Volume 45, Issue D1

January 2017

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**Nucleic acid sequence,
structure, and regulation**

Protein sequence and
structure, motifs, and
domains

Metabolic and signalling

Database issue

Nucleic acid sequence, structure, and regulation

The 24th annual *Nucleic Acids Research* database issue: a look back and upcoming changes FREE

Michael Y. Galperin; Xosé M. Fernández-Suárez; Daniel J. Rigden

[Abstract ▼](#) [View article](#)

**Database Resources of the National Center for
Biotechnology Information** FREE

[NCBI Resource Coordinators](#)

[Abstract ▼](#) [View article](#)

EBI/NCBI/DDBJ

Institute zabývající se shromažďováním, správou a poskytováním dat a informací a vývojem analytických nástrojů.

EBI

Evropský institut
pro bioinformatiku



European Bioinformatics Institute

NCBI

Národní centrum
pro biotechnologické
informace



National Center for Biotechnology Information

DDBJ Center



The DNA Data Bank of Japan Center

<http://www.ebi.ac.uk/>

<http://www.ncbi.nlm.nih.gov/>

<http://www.ddbj.nig.ac.jp/>

EBI – Evropský institut pro bioinformatiku



European Bioinformatics Institute

- Založen roku 1992 jako součást European Molecular Biology Laboratory - EMBL.
- Sídlo v Hinxtonu ve Velké Británii.

Welcome to the EBI

The European Bioinformatics Institute (EBI) is a non-profit academic organisation that forms part of the European Molecular Biology Laboratory ([EMBL](#)).

The EBI is a centre for research and services in bioinformatics. The Institute manages databases of biological data including nucleic acid, protein sequences and macromolecular structures.



Our Mission

- To provide freely available data and bioinformatics services to all facets of the scientific community in ways that promote scientific progress
- To contribute to the advancement of biology through basic investigator-driven research in bioinformatics
- To provide advanced bioinformatics training to scientists at all levels, from PhD students to independent investigators
- To help disseminate cutting-edge technologies to industry

NCBI - Národní centrum pro biotechnologické informace



National Center for Biotechnology Information

[National Library of Medicine](#)

[National Institutes of Health](#)

- Založeno v roce 1988 jako oddělení Národní lékařské knihovny (National Library of Medicine – NLM) v USA.
- Součást National Institutes of Health

► What does NCBI do?

Established in 1988 as a national resource for molecular biology information, NCBI creates public databases, conducts research in computational biology, develops software tools for analyzing genome data, and disseminates biomedical information - all for the better understanding of molecular processes affecting human health and disease.



DDBJ – The DNA Data Bank of Japan

- Založena jako oddělení Národního institutu genetiky (国立遺伝学研究所, NIG) v Japonsku.




<http://www.nig.ac.jp/>





▶▶ Information/Database

- ▶ DNA Data Bank of Japan
- ▶ National BioResource Project - Information Site
- ▶ WFCC-MIRCEN World Data Centre for Microorganisms
- ▶ Genetic Resources Database (SHIGEN)
- ▶ Nematode Gene Expression Database
- ▶ Mouse Microsatellite Database
- ▶ Rice Genome Database (Oryzabase)
- ▶ E.coli Genome Database (PEC)

 Virtual Museum of Genetics (Japanese)

 DNA Data Bank of Japan

 National BioResource Project

 Genome Network Project

Primární databáze NA

- **EMBL** - Evropský institut pro bioinformatiku



- **GenBank** - Národní centrum pro biotechnologické informace

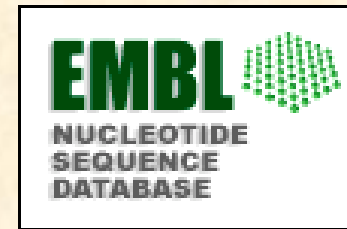


- **DDBJ** - Národní genetický institut (NIG)





EMBL



- **EMBL Nucleotide Sequence Database (EMBL-Bank) byla založena roku 1980 jako první databáze nukleotidových sekvencí.**
- **Obsahuje sekvence RNA a DNA.**
- **Zdroje sekvencí: vloženy přímo autory, genomové projekty, patenty**

**This week the EMBL Database contained
301,588,430,608 nucleotides in 199,575,971 entries**

This week = 20.4.2011



EMBL



- **EMBL Nucleotide Sequence Database (EMBL-Bank)**
– součást **ENA (European Nucleotide Archive)**.

About the European Nucleotide Archive

The European Nucleotide Archive ([ENA](#)) captures and presents information relating to experimental workflows that are based around nucleotide sequencing. A typical workflow includes the isolation and preparation of material for sequencing, a run of a sequencing machine in which sequencing data are produced and a subsequent bioinformatic analysis pipeline. ENA records this information in a data model that covers input information (sample, experimental setup, machine configuration), output machine data (sequence traces, reads and quality scores) and interpreted information (assembly, mapping, functional annotation).

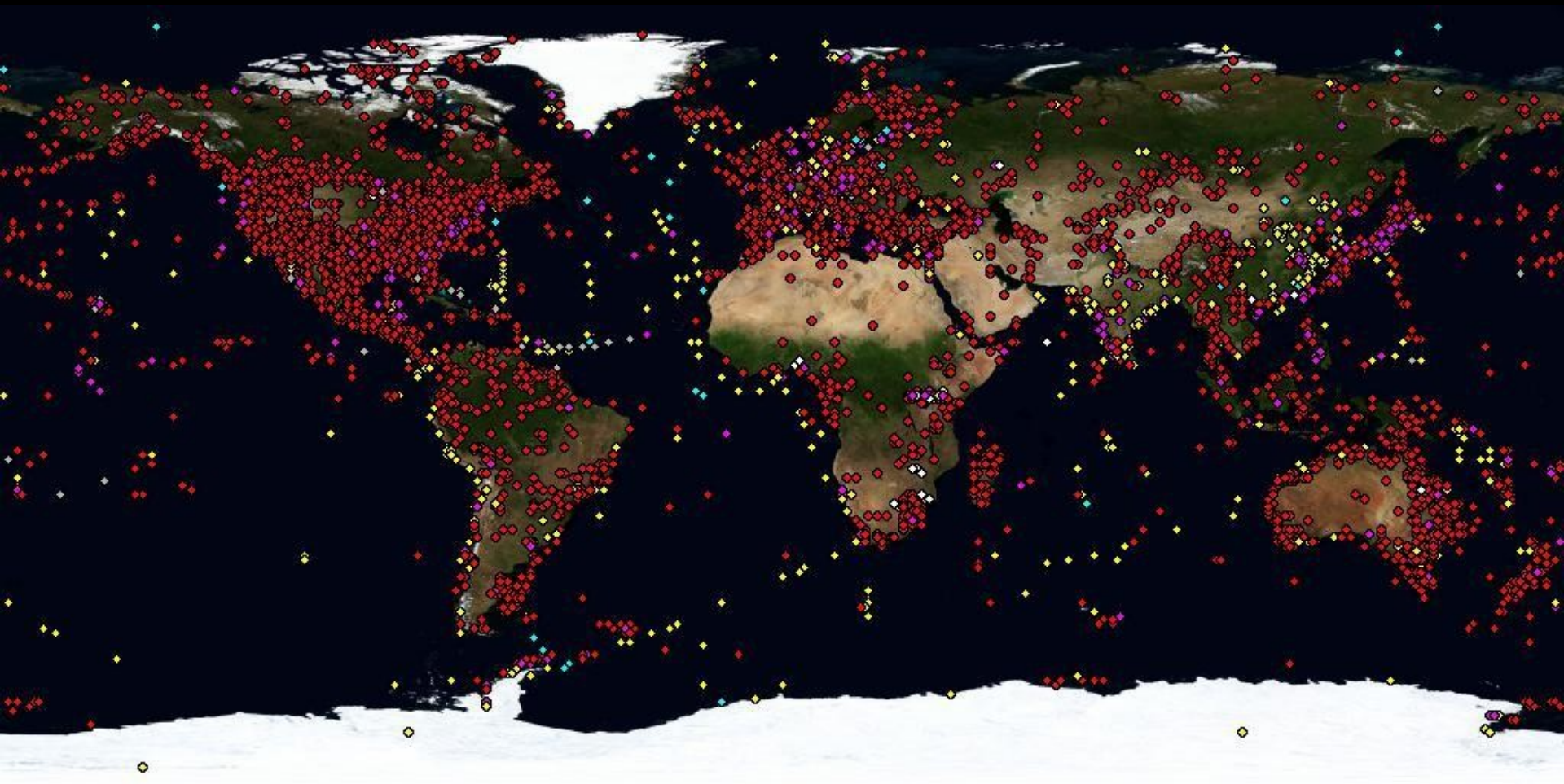
Data arrive at ENA from a variety of sources. These include submissions of raw data, assembled sequences and annotation from small-scale sequencing efforts, data provision from the major European sequencing centres and routine and comprehensive exchange with our partners in the International Nucleotide Sequence Database Collaboration (INSDC).

Provision of nucleotide sequence data to ENA or its INSDC partners has become a central and mandatory step in the dissemination of research findings to the scientific community. ENA works with publishers of scientific literature and funding bodies to ensure compliance with these principles and to provide optimal submission systems and data access tools that work seamlessly with the published literature.

ENA is made up of a number of distinct databases that includes EMBL-Bank, the newly established Sequence Read Archive (SRA) and the Trace Archive each with their own data formats and standards. ENA data classes and formats are described [here](#).

<http://www.ebi.ac.uk/ena/home>

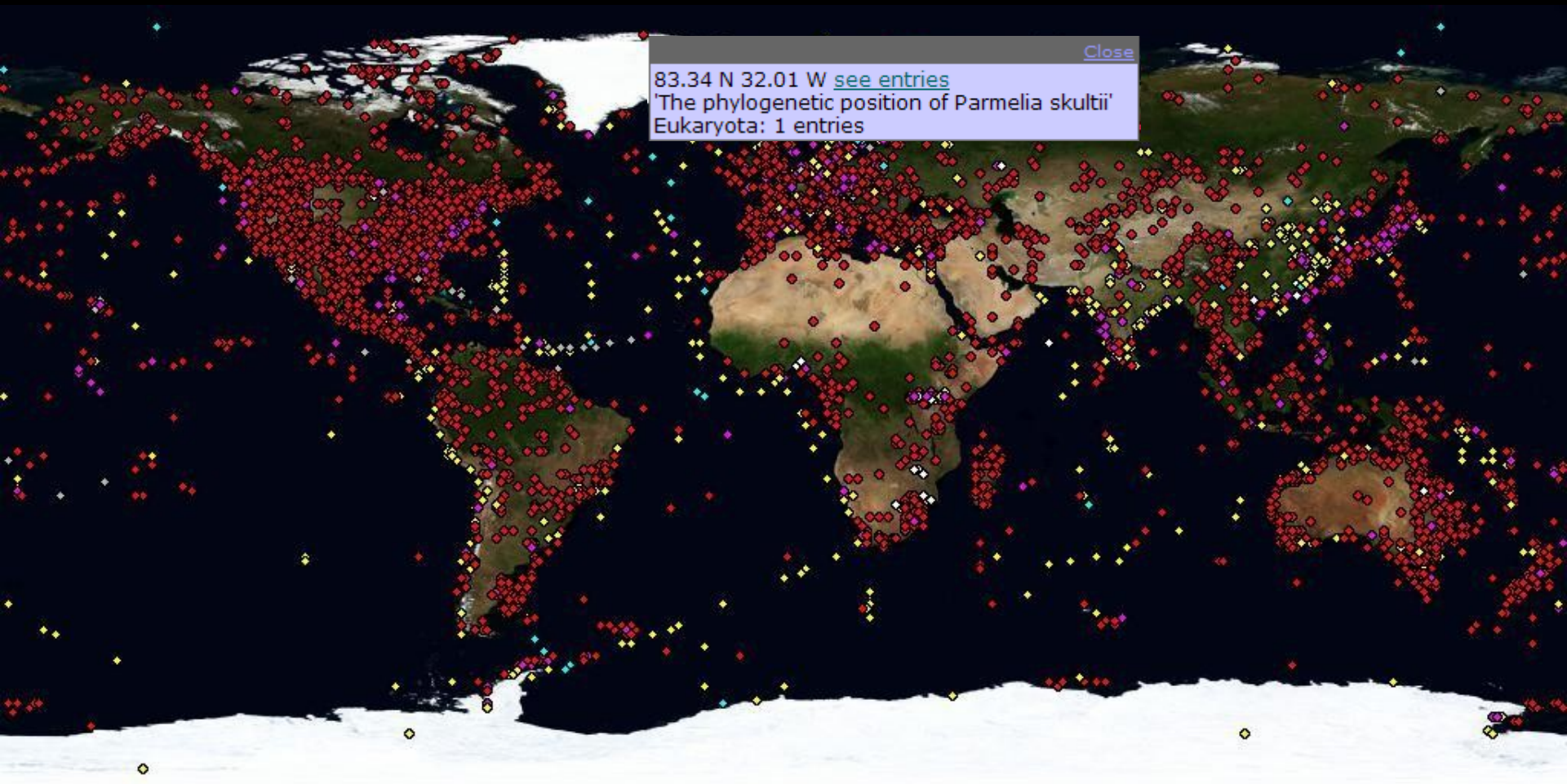
The map shows 18,628,656 entries distributed over 57,974 locations.



The dots on the map have different colours according to the taxonomy of the specimens:

 Eukaryota  Bacteria  Archaea  Other  Mixed

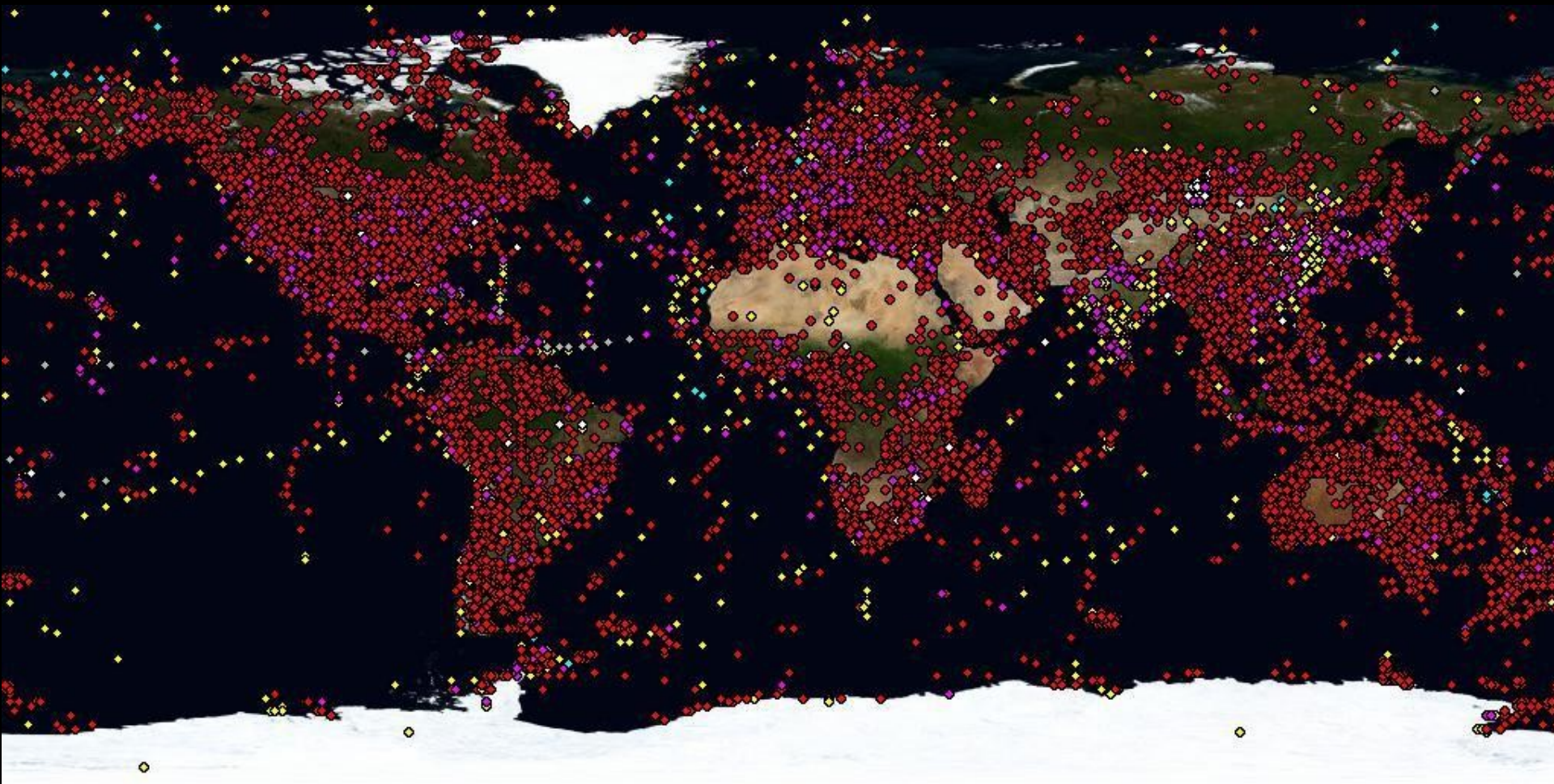
The map shows 18,628,656 entries distributed over 57,974 locations.



The dots on the map have different colours according to the taxonomy of the specimens:

 Eukaryota  Bacteria  Archaea  Other  Mixed

The map shows 18,710,024 entries distributed over 62,882 locations.



The dots on the map have different colours according to the taxonomy of the specimens:



Eukaryota



Bacteria



Archaea



Other



Mixed

ID X56734; SV 1; linear; mRNA; STD; PLN; 1859 BP.

XX

AC X56734; S46826;

XX

DT 12-SEP-1991 (Rel. 29, Created)

DT 25-NOV-2005 (Rel. 85, Last updated, Version 11)

XX

DE Trifolium repens mRNA for non-cyanogenic beta-glucosidase

XX

KW beta-glucosidase.

XX

OS Trifolium repens (white clover)

OC Eukaryota; Viridiplantae; Streptophyta; Embryophyta; Tracheophyta;

OC Spermatophyta; Magnoliophyta; eudicotyledons; core eudicotyledons; rosids;

OC eurosids I; Fabales; Fabaceae; Papilionoideae; Trifolieae; Trifolium.

XX

RN [5]

RP 1-1859

RX PUBMED; 1907511.

RA Oxtoby E., Dunn M.A., Pancoro A., Hughes M.A.;

RT "Nucleotide and derived amino acid sequence of the cyanogenic

RT beta-glucosidase (linamarase) from white clover (Trifolium repens L.);

RL Plant Mol. Biol. 17(2):209-219(1991).

XX

RN [6]

RP 1-1859

RA Hughes M.A.;

RT ;

RL Submitted (19-NOV-1990) to the EMBL/GenBank/DDBJ databases.

RL Hughes M.A., University of Newcastle Upon Tyne, Medical School, Newcastle

RL Upon Tyne, NE2 4HH, UK

EMBL (ENA)
„entry“

Translation = proteinová databáze

```
FT source 1..1859
FT /organism="Trifolium repens"
FT /mol_type="mRNA"
FT /clone_lib="lambda gt10"
FT /clone="TRE361"
FT /tissue_type="leaves"
FT /db_xref="taxon:3899"
FT CDS 14..1495
FT /product="beta-glucosidase"
FT /EC_number="3.2.1.21"
FT /note="non-cyanogenic"
FT /db_xref="GOA:P26204"
FT /db_xref="HSSP:P26205"
FT /db_xref="InterPro:IPR001360"
FT /db_xref="UniProtKB/Swiss-Prot:P26204"
FT /protein_id="CAA40058.1"
FT /translation="MDFIVAI FALFVISSFTITSTNAVEASTLLDIGNLSRSSFPRGFI
FT FGASSSNYQFEGAVNEGGRGPSIWDFTFKHYPEKIRDGSNADITVDQYHRYKEDVGI
FT DQNMDSYRFSISWPRILPKGKLSGGINHEGIKYNNLINELLANGIQPFVTLFHWDL
FT VLEDEYGGFLNSGVINDFRDYTDLCFKEFGDRVRYWSTLNEPWVFSNSGYALGT
FT CSASNVAKPGDSGTGPYIVTHNQILAHAEAVHVYKTKYQAYQKKGKIGITLVSN
FT DNSIPDIKAAERSLDFQFGLFMEQLTTGDYSKSMRRIVKNRLPKFSKFESSLVN
FT IGINYSSSYISNAPSHGNAKPSYSTNPMTNISFEKHGIPLGPRASIIWIYVYP
FT EDFEIFCYILKINITILQFSITENGMNEFNDATLPVEEALLNTYRIDYYRHL
FT IRAGSNVKGIFYAWSFLDCNEWFAGFTVRFGLNFVD"
FT mRNA 1..1859
FT /experiment="experimental evidence, no additional details
FT recorded"
XX
```

```
SQ Sequence 1859 BP; 609 A; 314 C; 355 G; 581 T; 0 other;
aaacaaacca aatattgatt ttattgtagc catatttgct ctgtttgta ttagctcatt 60
cacaattact tccacaaatg cagttgaagc ttctactctt cttgacatag gtaacctgag 120
tcggagcagt tttcctcgtg gcttcatctt tgggtgctgga tcttcagcat accaatttga 180
aggtgcagta aacgaaggcg gtagaggacc aagtatttgg gataccttca cccataaata 240
tccagaaaaa ataagggatg gaagcaatgc agacatcacg gttgaccaat atcaccgcta 300
caaggaagat gttgggatta tgaaggatca aaatatggat tcgtatagat tctcaatctc 360
ttgqccaaga atactcccaa aqgqaaaagt gagcggaggc ataaatcacg aaggaatcaa 420
```

Formát ENA databáze

ID	- identification	(begins each entry; 1 per entry)
AC	- accession number	(>=1 per entry)
PR	- project identifier	(0 or 1 per entry)
DT	- date	(2 per entry)
DE	- description	(>=1 per entry)
KW	- keyword	(>=1 per entry)
OS	- organism species	(>=1 per entry)
OC	- organism classification	(>=1 per entry)
OG	- organelle	(0 or 1 per entry)
RN	- reference number	(>=1 per entry)
RC	- reference comment	(>=0 per entry)
RP	- reference positions	(>=1 per entry)
RX	- reference cross-reference	(>=0 per entry)
RG	- reference group	(>=0 per entry)
RA	- reference author(s)	(>=0 per entry)
RT	- reference title	(>=1 per entry)
RL	- reference location	(>=1 per entry)
DR	- database cross-reference	(>=0 per entry)
CC	- comments or notes	(>=0 per entry)
AH	- assembly header	(0 or 1 per entry)
AS	- assembly information	(0 or >=1 per entry)
FH	- feature table header	(2 per entry)
FT	- feature table data	(>=2 per entry)
XX	- spacer line	(many per entry)
SQ	- sequence header	(1 per entry)
CO	- contig/construct line	(0 or >=1 per entry)
bb	- (blanks) sequence data	(>=1 per entry)
//	- termination line	(ends each entry; 1 per entry)

Formát ENA databáze

3.4.1 The ID Line

The ID (IDentification) line is always the first line of an entry. The format of the ID line is:

```
ID <1>; SV <2>; <3>; <4>; <5>; <6>; <7> BP.
```

The tokens represent:

1. Primary accession number
2. Sequence version number
3. Topology: 'circular' or 'linear'
4. Molecule type (see note 1 below)
5. Data class (see section 3.1)
6. Taxonomic division (see section 3.2)
7. Sequence length (see note 2 below)

```
ID CD789012; SV 4; linear; genomic DNA; HTG; MAM; 500 BP.
```

<ftp://ftp.ebi.ac.uk/pub/databases/embl/doc/usrman.txt>

Formát ENA databáze

3.1 Data Class

The data class of each entry, representing a methodological approach to the generation of the data or a type of data, is indicated on the first (ID) line of the entry. Each entry belongs to exactly one data class.

Class	Definition
-----	-----
CON	Entry constructed from segment entry sequences; if unannotated, annotation may be drawn from segment entries
PAT	Patent
EST	Expressed Sequence Tag
GSS	Genome Survey Sequence
HTC	High Throughput CDNA sequencing
HTG	High Throughput Genome sequencing
MGA	Mass Genome Annotation
WGS	Whole Genome Shotgun
TSA	Transcriptome Shotgun Assembly
STS	Sequence Tagged Site
STD	Standard (all entries not classified as above)

<ftp://ftp.ebi.ac.uk/pub/databases/embl/doc/usrman.txt>

Formát ENA databáze

Division	Code
-----	----
Bacteriophage	PHG
Environmental Sample	ENV
Fungal	FUN
Human	HUM
Invertebrate	INV
Other Mammal	MAM
Other Vertebrate	VRT
Mus musculus	MUS
Plant	PLN
Prokaryote	PRO
Other Rodent	ROD
Synthetic	SYN
Transgenic	TGN
Unclassified	UNC
Viral	VRL

<ftp://ftp.ebi.ac.uk/pub/databases/embl/doc/usrman.txt>

Sequence: AB849925.1 : Ipomoea nil GAPDH mRNA for glyceraldehyde-3-phosphate dehydrogenase, complete cds, cultivar: Violet.



View: [TEXT](#) [FASTA](#) [XML](#)

Download: [TEXT](#) [FASTA](#) [XML](#)

[Overview](#) [Source Feature\(s\)](#) [Other Features](#) [References](#) [Sequence](#)

[Send Feedback](#)

Organism Ipomoea nil	Molecule type mRNA	Topology linear	Data class STD	Taxonomic Division PLN
Sequence length 1,343	Sequence Version 1	First public 01-APR-2014	Last updated 01-APR-2014	Show Version History AB849925

Lineage

[Eukaryota](#), [Viridiplantae](#), [Streptophyta](#), [Embryophyta](#), [Tracheophyta](#), [Spermatophyta](#), [Magnoliophyta](#), [eudicotyledons](#), [Gunneridae](#), [Pentapetalae](#), [asterids](#), [lamiids](#), [Solanales](#), [Convolvulaceae](#), [Ipomoeae](#), [Ipomoea](#)

Navigation

[Top](#)



Taxon:

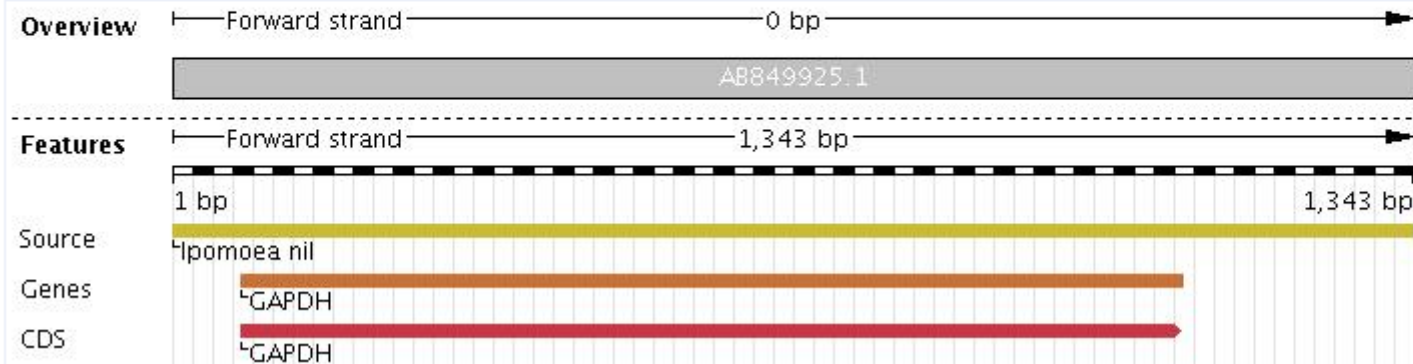
[Taxon:35883](#)

Overview

[Top](#)



Base range: -





GenBank

- **Založena roku 1982 v rámci institutu NCBI.**

GenBank[®] is the NIH genetic sequence database, an annotated collection of all publicly available DNA sequences (*Nucleic Acids Research*, 2008 Jan;36(Database issue):D25-30). There are approximately 85,759,586,764 bases in 82,853,685 sequence records in the traditional GenBank divisions and 108,635,736,141 bases in 27,439,206 sequence records in the WGS division as of February 2008.



Sample GenBank Record

<http://www.ncbi.nlm.nih.gov/Sitemap/samplerecord.html>



NCBI

Sample GenBank Record

LOCUS SCU49845 5028 bp DNA PLN 21-JUN-1999
DEFINITION Saccharomyces cerevisiae TCP1-beta gene, partial cds, and Axl2p
(AXL2) and Rev7p (REV7) genes, complete cds.
ACCESSION U49845
VERSION U49845.1 GI:1293613
KEYWORDS .
SOURCE Saccharomyces cerevisiae (baker's yeast)
ORGANISM Saccharomyces cerevisiae
Eukaryota; Fungi; Ascomycota; Saccharomycotina; Saccharomycetes;
Saccharomycetales; Saccharomycetaceae; Saccharomyces.
REFERENCE 1 (bases 1 to 5028)
AUTHORS Torpey,L.E., Gibbs,P.E., Nelson,J. and Lawrence,C.W.
TITLE Cloning and sequence of REV7, a gene whose function is required for
DNA damage-induced mutagenesis in Saccharomyces cerevisiae
JOURNAL Yeast 10 (11), 1503-1509 (1994)
PUBMED 7871890
REFERENCE 2 (bases 1 to 5028)
AUTHORS Roemer,T., Madden,K., Chang,J. and Snyder,M.
TITLE Selection of axial growth sites in yeast requires Axl2p, a novel
plasma membrane glycoprotein
JOURNAL Genes Dev. 10 (7), 777-793 (1996)
PUBMED 8846915
REFERENCE 3 (bases 1 to 5028)
AUTHORS Roemer,T.
TITLE Direct Submission
JOURNAL Submitted (22-FEB-1996) Terry Roemer, Biology, Yale University, New
Haven, CT, USA

<http://www.ncbi.nlm.nih.gov/Sitemap/samplerecord.html>



NCBI

Sample GenBank Record

LOCUS SCU49845 5028 bp DNA **PLN** 21-JUN-1999
 DEFINITION *Saccharomyces cerevisiae* TCP1-beta gene, partial cds, and Axl2p (AXL2) and Rev7p (REV7) genes, complete cds.

ACCESSION U49845
 VERSION U49845.1 GI:1293613
 KEYWORDS .
 SOURCE *Saccharomyces cerevi*
 ORGANISM *Saccharomyces cerevi*
 Eukaryota; Fungi; As
 Saccharomycetales; S
 REFERENCE 1 (bases 1 to 5028)
 AUTHORS Torpey,L.E., Gibbs,P
 TITLE Cloning and sequence
 DNA damage-induced m
 JOURNAL *Yeast* 10 (11), 1503-
 PUBMED 7871890
 REFERENCE 2 (bases 1 to 5028)
 AUTHORS Roemer,T., Madden,K.
 TITLE Selection of axial g
 plasma membrane glyc
 JOURNAL *Genes Dev.* 10 (7), 7
 PUBMED 8846915
 REFERENCE 3 (bases 1 to 5028)
 AUTHORS Roemer,T.
 TITLE [Direct Submission](#)
 JOURNAL Submitted (22-FEB-19
 Haven, CT, USA

GenBank Division

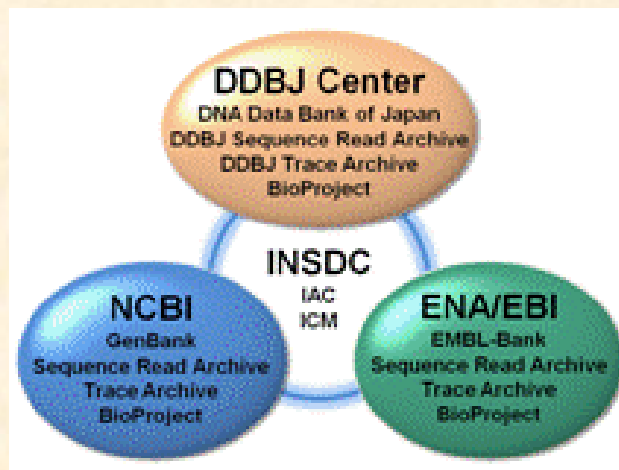
The GenBank division to which a record belongs is indicated with a three letter abbreviation. In this example, GenBank division is **PLN**.

The GenBank database is divided into 18 divisions:

1. PRI - primate sequences
2. ROD - rodent sequences
3. MAM - other mammalian sequences
4. VRT - other vertebrate sequences
5. INV - invertebrate sequences
6. PLN - plant, fungal, and algal sequences
7. BCT - bacterial sequences
8. VRL - viral sequences
9. PHG - bacteriophage sequences
10. SYN - synthetic sequences
11. UNA - unannotated sequences
12. EST - EST sequences (expressed sequence tags)
13. PAT - patent sequences
14. STS - STS sequences (sequence tagged sites)
15. GSS - GSS sequences (genome survey sequences)
16. HTG - HTG sequences (high-throughput genomic sequences)
17. HTC - unfinished high-throughput cDNA sequencing
18. ENV - environmental sampling sequences

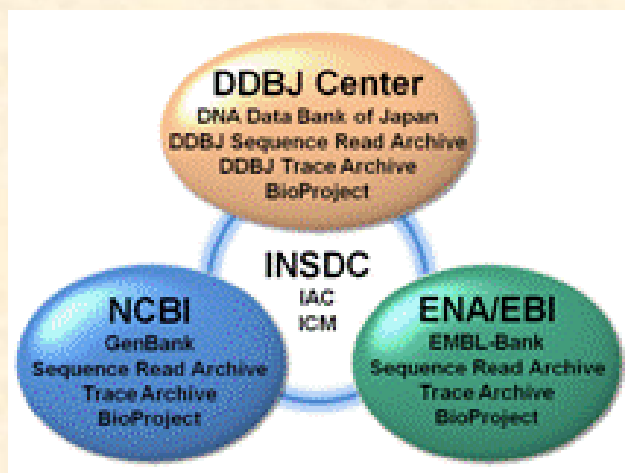
The DNA Data Bank of Japan

- Původně zahrnovala data především z japonských výzkumů.
- V současnosti úzká spolupráce s ostatními databázemi.





International Nucleotide Sequence Database Collaboration



<http://www.insdc.org/>

DDBJ: DNA Data Bank of Japan

CIB-DDBJ: Center for Information Biology and DNA Data Bank of Japan

NIG: National Institute of Genetics

EBI: European Bioinformatics Institute

EMBL: European Molecular Biology Laboratory

NCBI: National Center for Biotechnology Information

NLM: National Library of Medicine

IAC: International Advisory Committee

ICM: International Collaborative Meeting

<http://www.insdc.org/documents/feature-table#7.1.1>

Primární databáze proteinů

- **Univerzální databáze:**

„Skladiště“ sekvencí – sequence repository

Manuálně spravovaná – curated database

Příklad: GenBank *versus* RefSeq



National Center for Biotechnology Information

[National Library of Medicine](#)

[National Institutes of Health](#)

Primární databáze proteinů

GenBank

Not curated

Author submits

Only author can revise

Multiple records for same loci common

Records can contradict each other

No limit to species included

Data exchanged among INSDC members

Akin to primary literature

Proteins identified and linked

Access via NCBI Nucleotide databases

RefSeq

Curated

NCBI creates from existing data

NCBI revises as new data emerge

Single records for each molecule of major organisms

Limited to model organisms

Exclusive NCBI database

Akin to review articles

Proteins and transcripts identified and linked

Access via Nucleotide & Protein databases

GenPept - GenBank Gene Products Data Bank

RefSeq - Reference Sequence

- **Swiss-Prot** - „Curated“ databáze založená na Univerzitě v Ženevě v roce 1986. Spravovaná Švýcarským institutem pro bioinformatiku (**SIB - Swiss Institute of Bioinformatics**).
- Vysoká úroveň anotace → vkládáno více sekvencí než je možno manuálně anotovat a zařadit do databáze.
- **TrEMBL** – Počítačově anotovaná data, odvozená z kódujících úseku sekvencí v DDBJ/EMBL/GenBank, která **ZATÍM** nejsou zařazena v Swiss-Prot.



Swiss-PROT + TrEMBL



- **Anotace:**
 - Funkce**
 - Katalytická aktivita**
 - Podjednotky**
 - Domény**
 - Biotechnologické využití**
 - Sekvenční homologie**
 - Posttranslační modifikace**
 - Reference atd.**

Složené databáze

- **Databáze:**

Primární

Sekundární

Strukturní

Genomové zdroje

Složené databáze

Složené databáze

- **Složené (composite) databáze:**

Slučují data z několika primárních databází.

Eliminace redundantních dat.

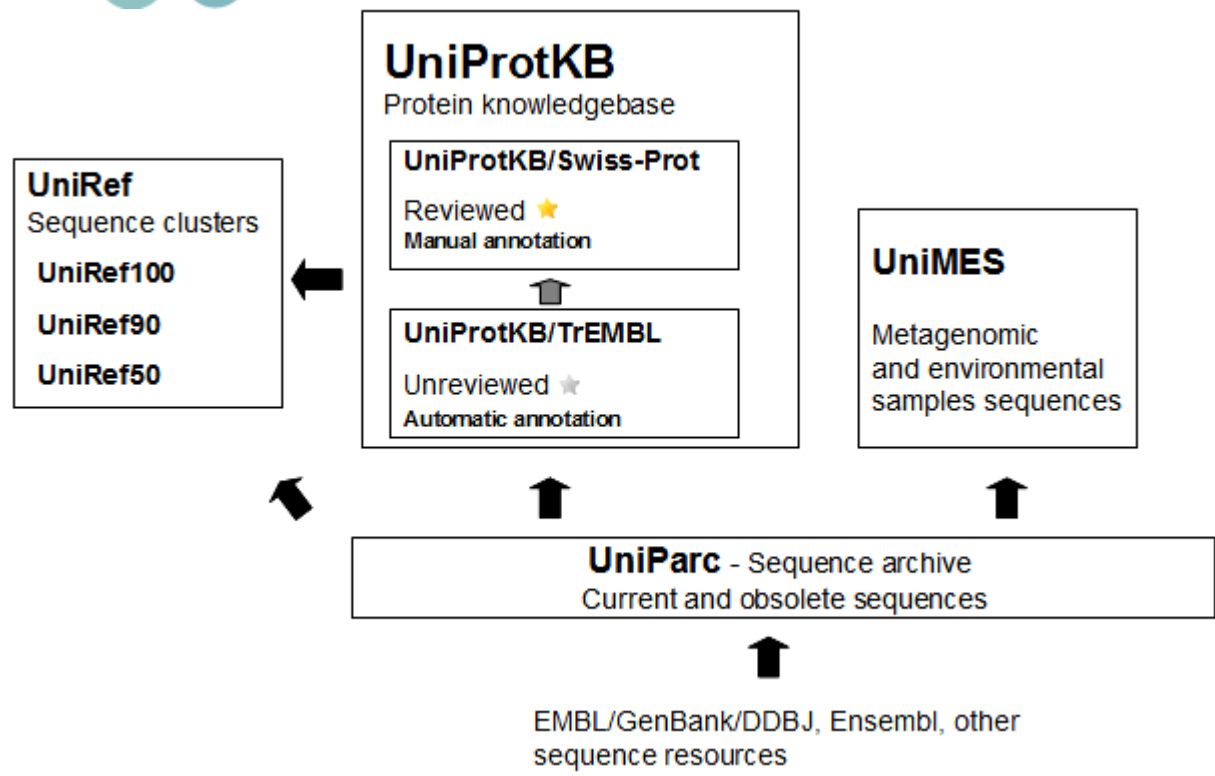
Různá priorita zdrojových databází podle kvality validace a anotace (eliminace redundantních dat z databáze s nižší prioritou).



Swiss-PROT + TrEMBL



UniProt



2002- spolupráce mezi EBI, SIB a PIR

<http://www.uniprot.org>

UniProtKB - P06858 (LIPL_HUMAN)

Basket

Display

- Entry
- Feature viewer
- Feature table
- None
- Function
- Names & Taxonomy
- Subcellular location
- Pathology & Biotech
- PTM / Processing
- Expression
- Interaction
- Structure
- Family & Domains
- Sequence
- Cross-references
- Publications
- Entry information
- Miscellaneous
- Similar proteins
- Top

BLAST Align Format Add to basket History

Feedback Help video Other tutorials and videos

Protein Lipoprotein lipase

Gene LPL

Organism Homo sapiens (Human)

Status Reviewed - Annotation score: [5 stars] - Experimental evidence at protein level¹

Function¹

The primary function of this lipase is the hydrolysis of triglycerides of circulating chylomicrons and very low density lipoproteins (VLDL). Binding to heparin sulfate proteoglycans at the cell surface is vital to the function. The apolipoprotein, APOC2, acts as a coactivator of LPL activity in the presence of lipids on the luminal surface of vascular endothelium (By similarity). [By similarity](#)

Catalytic activity¹
 Triacylglycerol + H₂O = diacylglycerol + a carboxylate. [1 Publication](#)

Sites

Feature key	Position(s)	Length	Description	Graphical view	Feature identifier	Actions
Active site ¹	159 - 159		1 Nucleophile			
Active site ¹	183 - 183		1 Charge relay system			
Active site ¹	268 - 268		1 Charge relay system			

GO - Molecular function¹

- apolipoprotein binding [Source: BHF-UCL](#)
- heparin binding [Source: BHF-UCL](#)
- lipoprotein lipase activity [Source: BHF-UCL](#)
- phospholipase activity [Source: BHF-UCL](#)
- receptor binding [Source: BHF-UCL](#)
- triglyceride binding [Source: Ensembl](#)
- triglyceride lipase activity [Source: BHF-UCL](#)



<https://www.youtube.com/watch?v=x9GNm2DLP-U>

Sekundární databáze NA a proteinů

Sekundární databáze obsahují informace odvozené z primárních databází ve formě charakteristických vzorů sekvencí, tj. funkčních nebo strukturních motivů získaných srovnáním primárních dat (sekvencí).

- Vyhledávání „vzoru“ charakteristického pro určitou skupinu proteinů.
- Možnost predikce funkce proteinů.

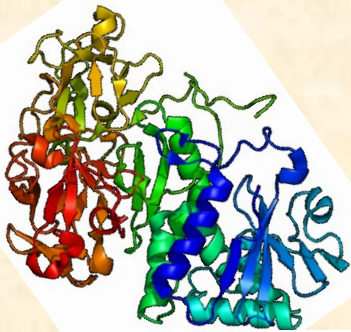
Sekundární databáze NA a proteinů

- **Databáze mohou obsahovat:**

Proteinové **DOMÉNY** odvozené ze známých struktur

Proteinové sekvence seřazené do **SEKVENČNÍCH RODIN**

CHARAKTERISTICKÉ MOTIVY odvozené z těchto sekvencí rodin.



```
LPPNTAFKAI FYANAADRQDLKLFIDD  
IPPNTDFRAIFFANAAEQOHIKLFIGD  
LPPHIKFGVTALTHAANDQTIDIYIDD  
LPPNIAFGVTALVNSSAPQTIEVFVDD
```

[AC]-x-V-x(4)-{ED}.

This pattern is translated as: [Ala or Cys]-any-Val-any-any-any-any-{any but Glu or Asp}

Sekundární databáze NA a proteinů

- **Sekundární proteinové databáze:**
PROSITE, Pfam, PRINTS, ProDom,
SMART, TIGRFAMS

V současné době sdruženy do integrované
klasifikační databáze proteinů **InterPro**

<http://www.ebi.ac.uk/interpro/>



Interpro
Protein sequence analysis & classification

[Table View](#)[Raw Output](#)[XML Output](#)[Original Sequences](#)[SUBMIT ANOTHER JOB](#)SEQUENCE: [Sequence_1](#) CRC64: B08AB341813AD2EE LENGTH: 382 aa**InterPro**[IPR000772](#)

Domain

InterPro

**Ricin B lectin**[PF00652](#)

Ricin_B_lectin

[SM00458](#)

RICIN

[PS50231](#)

RICIN_B_LLECTIN

InterPro[IPR001574](#)

Family

InterPro

**Ribosome-inactivating protein**[PF00161](#)

RIP

[SSF56371](#)

Ribosome_inactivat_prot

InterPro[IPR008997](#)

Domain

InterPro

**Ricin B-related lectin**[SSF50370](#)

RicinB_like

InterPro[IPR016139](#)

Domain

InterPro

**Ribosome-inactivating protein, subdomain 2**[G3DSA:4.10.470.10](#)

Ribosome_inactivat_prot_sub2

InterPro[IPR017989](#)

Family

InterPro

**Ribosome-inactivating protein subgroup**[PR00396](#)

SHIGARICIN

Sekundární databáze NA a proteinů

- **Sekundární proteinové databáze:**
PROSITE, Pfam, PRINTS, ProDom, SMART, TIGRFAMS
V současné době sdruženy do integrované klasifikační databáze proteinů **InterPro**
- **Sekundární databáze NA**
TRANSFAC

Strukturní databáze

Nucleic Acids Research

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[Carbohydrates](#)

[Nucleic acid structure](#)

[Protein structure](#)

[Genomics Databases \(non-vertebrate\)](#)

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[Human and other Vertebrate Genomes](#)

[Human Genes and Diseases](#)

[Microarray Data and other Gene Expression Databases](#)

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[Plant databases](#)

[Immunological databases](#)

Strukturní databáze proteinů

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[Nucleic acid structure](#)

[Protein structure](#)

[3D-Genomics](#)

[3DID - 3D interacting domains](#)

[ArchDB](#)

[AS-ALPS](#)

[ASTRAL](#)

[AutoPSI](#)

[BANMOKI](#)

[BioMagResBank](#)

[CADB - Conformational Angles DataBase of Proteins](#)

[CATH](#)

[CC+](#)

[CE](#)

[CoC Central](#)

[ColiSNP](#)

[Columba](#)

[ConSurf-DB](#)

[CPDB](#)

[CSA - Catalytic Site Atlas](#)

[DisProt - Database of Protein Disorder](#)

[DMAPS](#)

[Dockground](#)

[DomIns - Database of Domain Insertions](#)

[DSDBASE - Disulfide Database](#)

[DSMM - a Database of Simulated Molecular Motions](#)

[E-MSD - EBI-Macromolecular Structure Database](#)

[eF-site - Electrostatic surface of Functional site](#)

[EzCatDB](#)

[FireDB](#)

[FSN](#)

[Gene3D](#)

[Genomic Threading Database](#)

[GTOP - Genomes To Protein structures](#)

[HOMSTRAD - Homologous Structure Alignment Database](#)

[HotSprint](#)

[IMGT/3Dstructure-DB](#)

[IMOTdb](#)

[JAIL](#)

[Jenalib: Jena Library of Biological Macromolecules](#)

[KineticDB](#)

[LPFC](#)

[MALISAM](#)

[MegaMotifbase](#)

[MMDB](#)

[ModBase](#)

[MolMovDB - Database of Macromolecular Movements](#)

[PASSz](#)

[PDB](#)

[PDB-REFRDB](#)

[PDBselect](#)

[PDBsum](#)



An Information Portal to
129184 Biological
Macromolecular Structures

- Databáze obsahuje experimentálně získané struktury proteinů, **nukleových kyselin** a komplexů informačních biomakromolekul.

PDB Current Holdings Breakdown

Exp.Method	Proteins	Nucleic Acids	Protein/NA Complexes	Other	Total
X-RAY	108294	1826	5502	4	115626
NMR	10332	1196	241	8	11777
ELECTRON MICROSCOPY	1058	30	377	0	1465
HYBRID	99	3	2	1	105
other	188	4	6	13	211
Total	119971	3059	6128	26	129184

PDB formát

PDB File Format

The Protein Data Bank (PDB) format provides a standard representation for macromolecular structure data derived from X-ray diffraction and NMR studies. This representation was created in the 1970's and a large amount of software using it has been written.

Looking at Structures

- Introduction
- Biological Assemblies
- Dealing with Coordinates
- Methods for Determining Structure
- Missing Coordinates and Biological Assemblies
- Molecular Graphics Programs
- Resolution
- R-value and R-free
- Structure Factors and Electron Density
- Primary Sequences and the PDB Format

- PDB formát – původní formát databáze.
- 1997 – mmCIF (macromolecular Crystallographic Information File).
- Záznamy jsou v databázi uloženy v obou formátech a volně stažitelné.
- PDB formát – rozeznáván téměř všemi programy pro práci se strukturami.

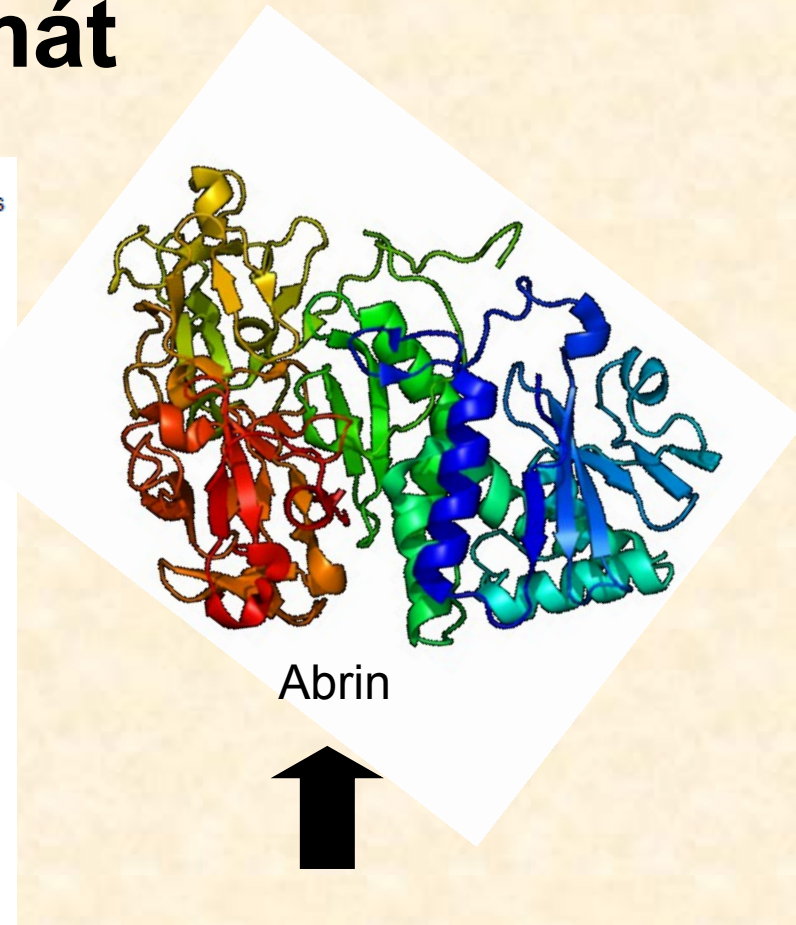
PDB formát

The ATOM records present the atomic coordinates for standard amino acids and nucleotides. They also present the occupancy and temperature factor for each atom. Non-polymer chemical coordinates use the HETATM record type. The element symbol is always present on each ATOM record; charge is optional.

Changes in ATOM/HETATM records result from the standardization atom and residue nomenclature. This nomenclature is described in the Chemical Component Dictionary (<ftp://ftp.wwpdb.org/pub/pdb/data/monomers>).

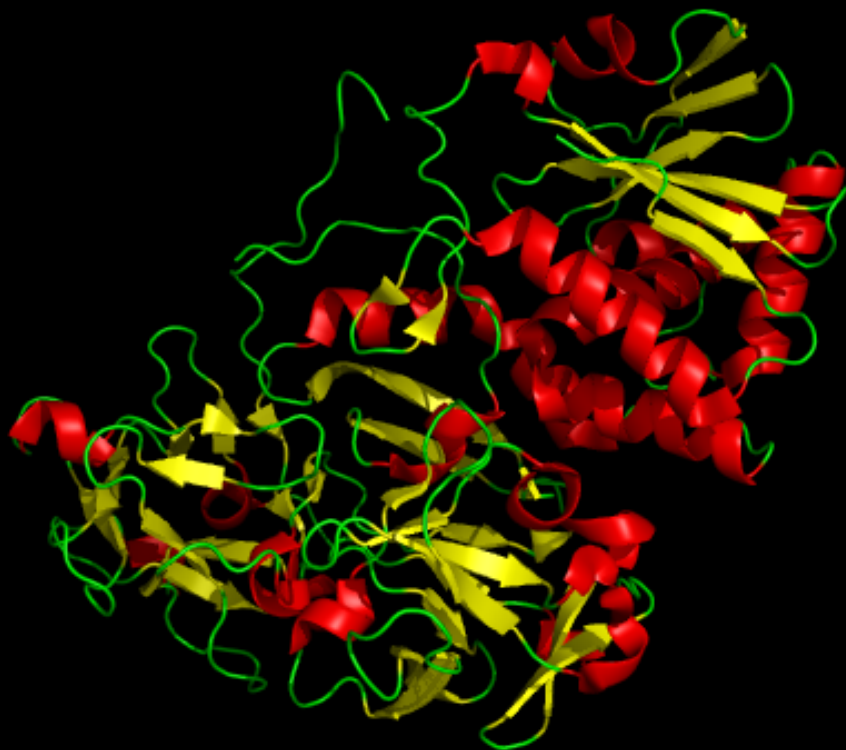
Record Format

COLUMNS	DATA TYPE	FIELD	DEFINITION
1 - 6	Record name	"ATOM "	
7 - 11	Integer	serial	Atom serial number.
13 - 16	Atom	name	Atom name.
17	Character	altLoc	Alternate location indicator.
18 - 20	Residue name	resName	Residue name.
22	Character	chainID	Chain identifier.
23 - 26	Integer	resSeq	Residue sequence number.
27	AChar	iCode	Code for insertion of residues.
31 - 38	Real(8.3)	x	Orthogonal coordinates for X in Angstroms.
39 - 46	Real(8.3)	y	Ortho
47 - 54	Real(8.3)	z	Ortho
55 - 60	Real(6.2)	occupancy	Occup
61 - 66	Real(6.2)	tempFactor	Tempe
77 - 78	LString(2)	element	Elem
79 - 80	LString(2)	charge	Charg



ATOM	2	CA	GLU	A	1	64.373	11.709	60.583	1.00	79.99	C
ATOM	3	C	GLU	A	1	63.512	10.438	60.597	1.00	79.31	C
ATOM	4	O	GLU	A	1	63.540	9.685	61.574	1.00	79.23	O
ATOM	5	CB	GLU	A	1	63.805	12.754	59.603	1.00	79.36	C
ATOM	6	CG	GLU	A	1	62.880	13.819	60.228	1.00	78.52	C
ATOM	7	CD	GLU	A	1	61.525	13.275	60.676	1.00	78.50	C
ATOM	8	OE1	GLU	A	1	60.915	12.482	59.923	1.00	77.14	O
ATOM	9	OE2	GLU	A	1	61.064	13.659	61.776	1.00	77.48	O
ATOM	10	H1	GLU	A	1	66.078	10.648	60.914	1.00	20.00	H
ATOM	11	H2	GLU	A	1	65.776	10.893	59.265	1.00	20.00	H
ATOM	12	H3	GLU	A	1	66.387	12.177	60.222	1.00	20.00	H

/1abr 1 6 11 16 21 26 31 36 41 46 51 56 61 66 71
PPN IVEKSKICSSRYEPTVRIGGRDGMCDVYDNGYHNGNRIIMWKCKDRLEENQLWTLKSDKTIRSNGKCLTTYG



Color:

- by element
- by chain
- by ss
- spectrum
- auto
- reds
- greens
- blues
- yellows
- magentas
- cyans
- oranges
- tints
- grays

By Secondary Structure:

- Helix Sheet Loop
- Helix Sheet Loop

Mouse Mode 3-Button Viewing

Buttons	L	M	R	Wheel
& Keys	Rota	Move	MovZ	Slab
Shft	+Box	-Box	Clip	MovS
Ctrl	+/-	PkAt	Pk1	MvSZ
CtSh	Sele	Orig	Clip	MovZ
SnglClk	+/-	Cent	Menu	
DblClk	Menu	-	PkAt	

Selecting Residues
Frame [1/ 1] 0/sec



EMDataBank
Unified Data Resource for 3DEM

<http://emdatbank.org/>

One-stop shop for 3DEM deposition and retrieval

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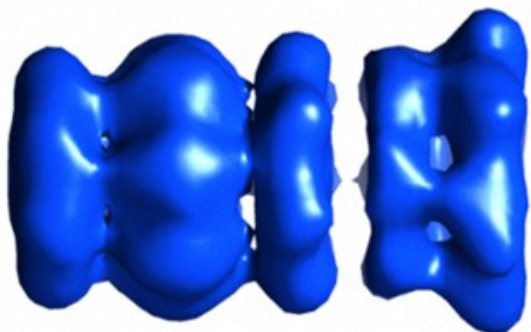
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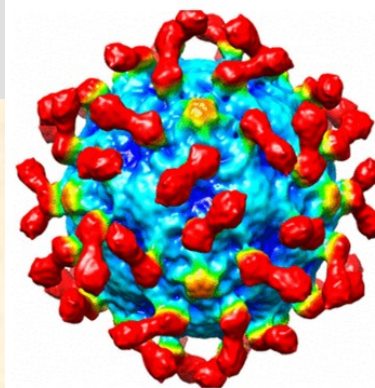
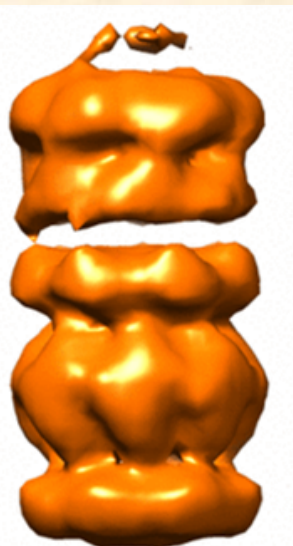
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EMDataBank is a unified global portal for deposition and retrieval of 3DEM density maps, atomic models, and associated metadata, as well as a resource for news, events, software tools, data standards, validation methods for the 3DEM community.



March 13, 2014 RELEASED ON April 9, 2014 singleParticle 42.0Å **NEW**

Architecture and assembly of the archaeal Cdc48-20S proteasome



March 19, 2014 RELEASED ON April 9, 2014 singleParticle 9.0Å **NEW**

Kinetic and Structural Analysis of Cocksackievirus B3 Receptor Interactions and Formation of the A-particle



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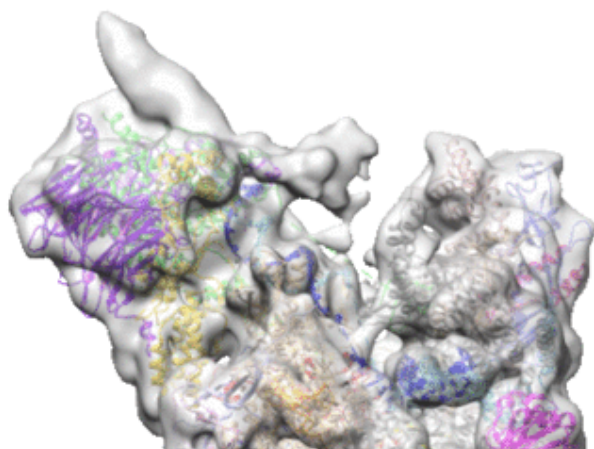
Unified Data Resource for 3-Dimensional Electron Microscopy

EMDataBank is a unified global portal for deposition and retrieval of 3DEM density maps, atomic models, and associated metadata, as well as a resource for news, events, software tools, data standards, validation methods for the 3DEM community.

For up-to-date information about map and model challenges, visit challenges.emdatabank.org.

Recently released entries

[All recent entries](#)



**EMD-3594, 3590, 3591,
3592, 3593**

[PDBe](#) | [RCSB](#)

Feb. 14, 2017 RELEASED ON April 12, 2017 singleParticle 3.4Å **NEW**

RNA polymerase I initially transcribing complex with visible tandem Winged Helix domain

News

[All news](#)

The paper describing wwPDB OneDep system is now available

The paper describing wwPDB OneDep system is now available. The wwPDB has deployed a unified system for deposition, biocuration, and validation of macromolecular structures globally across all wwPDB, EMDB, and BMRB deposition sites to meet the evolving requirements of the scientific community to archive structural data over the coming decades.

[Read more...](#)

EM Archives to be Mirrored in China

19 January 2017: This week, a delegation from the Society of Chinese Cryo Electron Microscopy (SCCEM) visited EMBL-EBI to discuss how cryo-EM data in EMDB and



<https://www.online.muni.cz/vite/4724-kryo-elektronovy-mikroskop-nahlizi-do-nitra-bunek>

„Vysoké rozlišovací schopnosti mikroskopu také kladou speciální požadavky na prostory, ve kterých může být takový mikroskop umístěn. Expozice vzorku trvá kolem jedné vteřiny, kdy se nesmí vzorek ani přístroj pohnout byť o desetinu nanometru (10^{-10} m). Seběmenší vibrace během expozice by totiž znemožnily přesná měření. Přístroj vysoký čtyři metry vážící 2000 kilogramů a vyžadující napětí 300 kilovoltů musí proto být umístěn ve speciálně postavených prostorech s oddělenými základy, které izolují mikroskop od vibrací celé budovy. Navíc, místnost musí být izolována od jakýchkoli rušivých elektromagnetických polí. Proto ani nemohou jezdit v blízkosti budovy s mikroskopy tramvaje či trolejbusy, které by způsobovaly silné vibrace a narušovaly elektromagnetické pole a elektronový svazek v mikroskopu.“

Strukturní databáze NA

Nucleic Acids Research

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[Oxford Journals](#) > [Life Sciences](#) > [Nucleic Acids Research](#) > Database Summary Paper

2011 NAR Database Summary Paper

[Nucleotide Sequence Databases](#)

[RNA sequence databases](#)

[Protein sequence databases](#)

[Structure Databases](#)

[Small molecules](#)

[Carbohydrates](#)

[Nucleic acid structure](#)

[3DNALandscapes](#)

[Greglist](#)

[GRSDB](#)

[ITS2](#)

[MeRNA](#)

[NCIR - Non-Canonical Interactions in RNA](#)

[NDB](#)

[NNDB](#)

[non-B DB](#)

[NTDB](#)

[QuadBase](#)

[Rfam](#)

[RNA FRABASE](#)

[RNA SSTRAND](#)

[RNAJunction](#)

[SARS-CoV RNA SSS](#)

[SCOR - Structural Classification Of RNA](#)

[Vir-Mir db](#)

NDB - Nucleic Acid Database



A Portal for Three-dimensional Structural Information about Nucleic Acids
As of 5-Apr-2017 number of released structures: 8793

Welcome to the NDB

The NDB contains information about experimentally-determined nucleic acids and complex assemblies. Use the NDB to perform searches based on annotations relating to sequence, structure and function, and to download, analyze, and learn about nucleic acids.

Search Structures

Search DNA

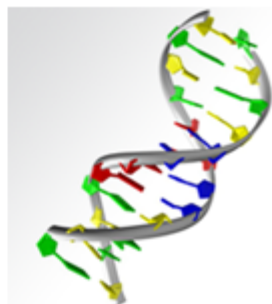
Search DNA and its complexes

Search RNA

Search for RNA structures in the NDB archive or in the Non-Redundant list

Advanced Search

Search for structures based on structural features, chemical features, binding modes, citation and experimental information



Featured Tools

RNA 3D Motif Atlas, a representative collection of RNA 3D internal and hairpin loop motifs

Non-redundant Lists of RNA-containing 3D structures

RNA Base Triple Atlas, a collection of motifs consisting of two RNA basepairs

WebFR3D, a webserver for symbolic and geometric searching of RNA 3D structures

R3D Align, an application for detailed nucleotide to nucleotide alignments of RNA 3D structures



<http://ndbserver.rutgers.edu/>

About NDB

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Download

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Nucleic Acids

Definition of terms

NA Highlights from
PDB-101

Paper Models

Musical Atlas

Links

INTRODUCTION

DNA can be represented in a variety of ways, which can provide different visual perspectives of molecular structure.

DNA can also be aurally represented when a correspondence is created between the bases and musical notes, as seen in Dr. David Deamer's earlier work DNA Suite (1983).

This Musical Atlas presents an aural representation of the B-DNA molecules without mismatches, drugs, or modifiers that were contained in the NDB as of July 25, 1996.

This atlas follows a newly created pattern. For each structure, there is a "Plain Melody," which follows a simple algorithm to highlight the structure's sequence, and a "Composition," which follows a more complicated algorithm that features the base pairing of the structure.

These algorithms contain rules for determining the meter and rhythm for each piece.

In each case, the notes are assigned to each base as follows:

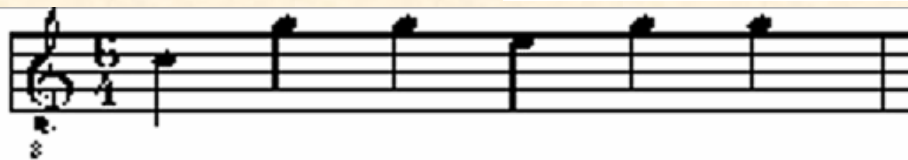
Adenine	A	Cytosine	C
Thymine	E	Guanine	G

These are found within the range a to g¹.

Each base of the asymmetric strand is given one note. The strand is read 5' to 3'.

Thymine was assigned to E so that the four bases would fall into an a minor seventh chord.

The Plain Melody
for BDF062,
Strand A (C G C T G G)



<http://ndbserver.rutgers.edu/>

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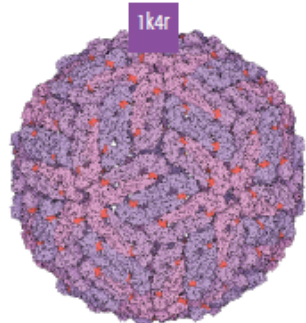
DNA

Download this **PDF** to build one complete turn of a DNA double helix, with the major and minor grooves labeled. Choose from a schematic model with space to fill in the names of the bases and a detailed model that shows all the atoms in each nucleotide.



RCSB PDB-101
www.rcsb.org • info@rcsb.org

Build a Paper Model of Dengue Virus



This paper model of PDB entry 1k4r shows the virus magnified by 1,500,000 times. The RNA genome, which contains 10,649 nucleotides, can be modeled using a piece of string approximately 5.4 meters long and placed inside of the structure.



To build the dengue virus, **cut** out the protein structure below and **fold** along the dotted lines. Then **tape** or glue the flaps into place to form an icosahedron.



For more information about dengue virus, see the RCSB PDB's *Molecule of the Month* at dx.doi.org/10.2210/rcsb_pdb/mom_2008_7



To learn about dengue fever, see the National Institute of Allergy and Infectious Diseases' site at www.niaid.nih.gov/topics/denguefever/

Genomové zdroje

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[RNA sequence databases](#)

[Protein sequence databases](#)

[Structure Databases](#)

[Genomics Databases \(non-vertebrate\)](#)

[MGD - Mouse Genome Database](#)

[TIGR Gene Indices](#)

[Genome annotation terms, ontologies and nomenclature](#)

[Taxonomy and identification](#)

[General genomics databases](#)

[Viral genome databases](#)

[Prokaryotic genome databases](#)

[Unicellular eukaryotes genome databases](#)

[Fungal genome databases](#)

[Invertebrate genome databases](#)

**EBI, NCBI – genomové
databáze**

Vyhledávací systémy

- **Nutnost organizovaného ukládání a skladování dat.**
- **Nutnost prohlížení a analyzování uložených dat.**



Databáze je určitá uspořádaná množina informací (dat) uložená na paměťovém médiu.

V širším smyslu jsou součástí databáze i softwarové prostředky, které umožňují manipulaci s uloženými daty a **přístup k nim.**

Vyhledávací systémy



- **Textové vyhledávání v databázích**
NCBI – Entrez

<http://www.ncbi.nlm.nih.gov/gquery/>

Entrez is the integrated, text-based search and retrieval system used at NCBI for the major databases, including PubMed, Nucleotide and Protein Sequences, Protein Structures, Complete Genomes, Taxonomy, and others.

<http://www.ncbi.nlm.nih.gov/books/NBK3837/>



U.S. National Library of Medicine
National Institutes of Health

Welcome to PubMed

PubMed comprises more than 19 million citations for biomedical articles from MEDLINE and life science journals. Citations may include links to full-text articles from PubMed Central or publisher web sites.

Search NCBI databases

Literature

7598 **PubMed:** scientific & medical abstracts/citations

10415 **PubMed Central:** full-text journal articles

50 **NLM Catalog:** books, journals and more in the NLM Collections

13 **MeSH:** ontology used for PubMed indexing

273 **Books:** books and reports

26 **Site Search:** NCBI web and FTP site index

Health

18 **PubMed Health:** clinical effectiveness, disease and drug reports

3 **MedGen:** medical genetics literature and links

(none) **GTR:** genetic testing registry

426 **dbGaP:** genotype/phenotype interaction studies

1 **ClinVar:** human variations of clinical significance

12 **OMIM:** online mendelian inheritance in man

(none) **OMIA:** online mendelian inheritance in animals

Organisms

1 **Taxonomy:** taxonomic classification and nomenclature catalog

Explore the EBI:

Examples: [blast](#), [keratin](#), [bfl1...](#)

EBI Search

Examples: [VAV_HUMAN](#), [tpi1](#), [Sulston ...](#)

[Advanced](#)

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About EBI Search

The EBI Search engine, also known as EB-eye, is a scalable text search engine that provides easy and uniform access to the biological data resources hosted at the EMBL-EBI.

The data resources represented in the EBI Search engine include: nucleotide and protein sequences at both the genomic and proteomic levels, structures ranging from chemicals to macro-molecular complexes, gene-expression experiments, binary level molecular interactions as well as reaction maps and pathway models, functional classifications, biological ontologies, and comprehensive literature libraries covering the biomedical sciences and related intellectual property.

The EBI Search presents search results that are up-to-date with the data resources and provides an easy inter-domain navigation via a network of cross-references.

<http://www.ebi.ac.uk/ebisearch/>

Vyhledávací systémy

- **Vyhledávání podobností sekvencí**

Textové vyhledávání může selhat (nedostatečná anotace).

Vyskytuje se shodná nebo podobná sekvence v databázi? (Identifikace možné funkce na základě homologie.)

- **Specializované nástroje (algoritmy) pro „seřazení“ (alignment) sekvencí.**

```
LPPNTAFKAIIFYANAADRQDLKLFIDDAPEPAATFVGNSEdGVRL--FTLNSKGGKIRIE
IPPNTDFRAIFFANAAEQOHIKLFIGDSQEPAA YHKLTRDGPRe--ATLNSGNGKIRFE
LPPHIKFGVtALThAANDQTIDIYIDDpKPAATFKGAGAQDQNLGtKVLDSGNGRVrVI
LPPNIAFGVtALVNSSAPQTIEVFVDDNPKPAATFQGAGTQDANLNTQIVNSGKGKVRrVV
lPPn-aFg---lanaad-QtiklfidD-p-PAAtfkgag-----l-t-tlnSgnGkiRve
```

```
ASANGRQ SATDARLAPLSAGD-----TVWLGWLGAE DGADADYNDGI VILQWPI T
VSVNGKPSATDARLAPINGKKSdGSPF TVNFGI VVSEdGHDS DYNDGI VVLQWPI G
VMANGRPSRLGSRQVDIFKKS-----YFGIIGSEdGADDDYNDGI VFLNWPLG
VTANGKPSKIGSRQVDIFKKT-----YFGLVGS EdGGDGDYNDGI AILNWPLG
vsANGrpSat--R---ifkks-----tvyfGivgsEdGaDaDYNDGI viLqWPiG
```

Shrnutí

- Výrazný nárůst množství biologických dat vede k nutnosti jejich **organizovaného skladování a analyzování (databáze)**.
- Instituce pro správu dat a vývoj nástrojů pro analýzu: **EBI/NCBI/CIB**
- Základní rozdělení databází:
primární/sekundární/strukturní databáze
- **Textové vyhledávací systémy/ alignment**